New horizons of high resolution spectral sensors for convenient, reliable and affordable spectral measurements

Dr. Fred Grunert / BL CSS

March 2017

CSS Business Line

Color & Spectral Sensing Key Facts

- Advanced Optical Sensing Division
  - Experts for spectral and color sensing
  - Focus on non-mobile phone applications
  - Industry-leading optical design team
  - Application-specific in-house software development
  - Optical range from UV → VIS → IR

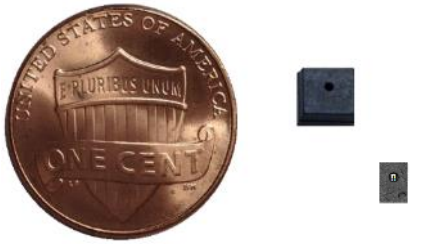
- Design & Manufacturing
  - Offices: Austria, USA, Germany
  - Opto-mechanical design support
  - Optical packaging expertise
  - Rigorous qualification processes
  - High-volume and proven global supply chain

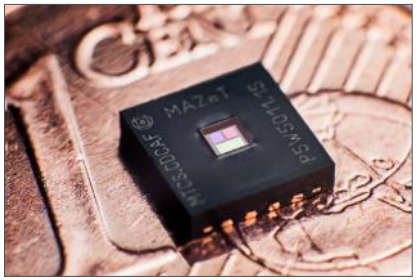
Growth and investment area for ams ~100 people

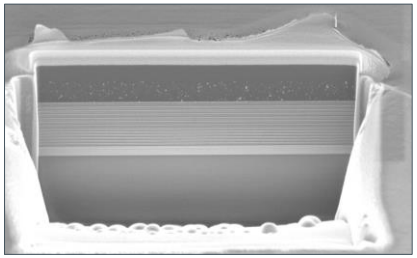
ams Spectral Sensing Technology

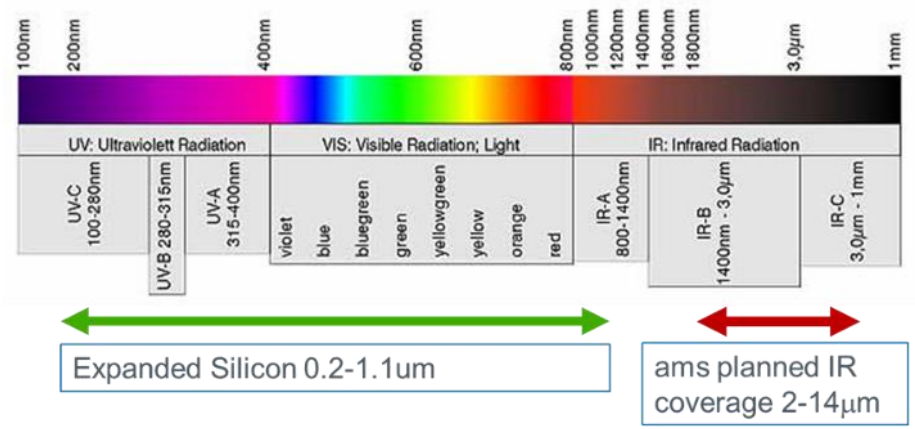
Benefits of Spectral Sensing

- In-fab filter technology for robust inorganic nano-optic interference filters
- High volume production and test for optical sensors → repeatable, consistent, reliable, long-term stable
- Filter standards for direct customer applications & customizable filter sets on same platform for customer specific applications
- Highest level of integration available at competitive price points





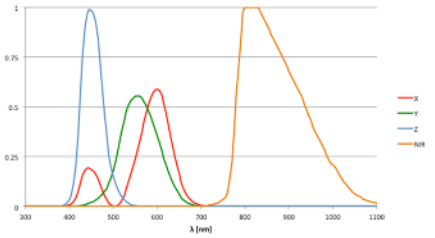


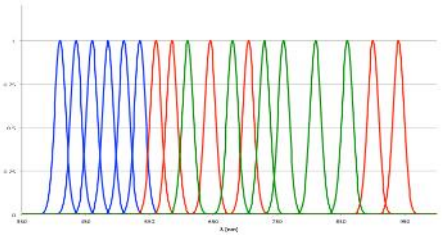


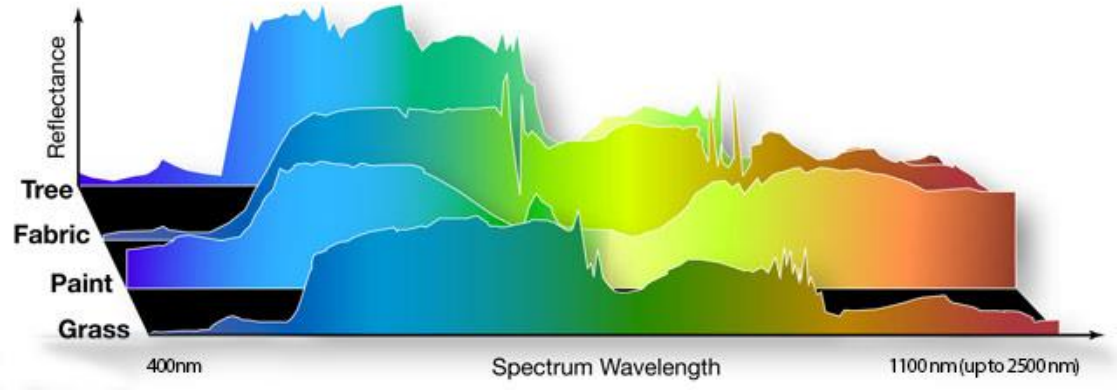
Unleashing knowledge through light

Optical sensing to detect spectral fingerprints – “seeing” the invisible

- Each filter will detect a different wavelength enabling the sensor to determine the material's characteristics
- Spectral sensors can open up a broad range of applications
- Sensors for authentication and detection of food quality, bacteria contamination and counterfeit products







Color & Spectral Sensing - Markets and Applications

Smart Lighting - Home & Building

- Smart light color tuning
- Daylight control
- Presence detection
- Fire detection

Consumer Spectral

- Display calibration
- Color matching
- Food inspection
- Light metering

Agriculture

- Growth sensor
- Harvest analysis
- Grow light control

Automotive / Aviation

- In cabin CO^2 detection
- Interior lighting control

White Goods

- Water turbidity & color
- Detergent identification
- Human Machine Interface (Gesture, display calibration)

Industrial

- Quality control
- Production
- Automation
- Fabric monitoring

Medical & Wellness

- Body fluid analysis
- Medicine authentication
- Heart Rate Monitoring
- Exposure to light

Fluid Analysis

- Water analysis (with reagents)
- Color and spectral identification
- Fuel/Oil monitoring
- Industrial fluids

The AS726X Platform

A New Class of Spectral Sensing

AS7261

True Color (XYZ+)

- 6 filters XYZ, clear, dark + NIR
- Spectral Sensing Engine
- Smart Interface

AS7262

Chromatic

- 6 VIS filters
- Spectral Sensing Engine
- Smart Interface

AS7263

Visible/Near-IR

- 6 VIS/NIR filters
- Spectral Sensing Engine
- Smart Interface

AS7264A

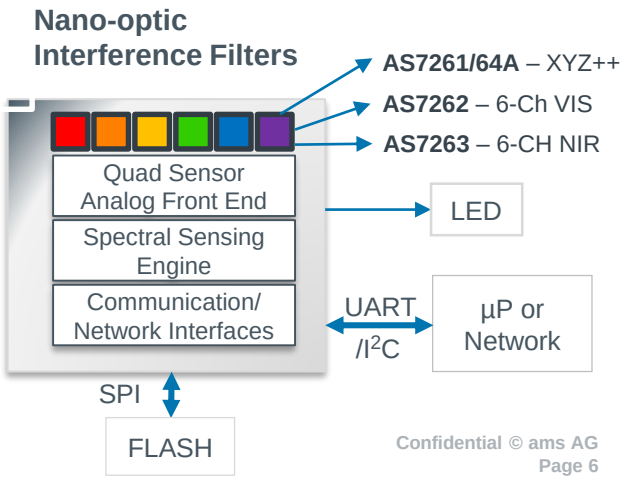
XYZ + Special Blue

- XYZ for CCT
- 440nm + 490nm
- I2C only

AS726x chip set

Multi-spectral

- 3 chip 18 channel
- Spectral Sensing Engine
- Smart Interface

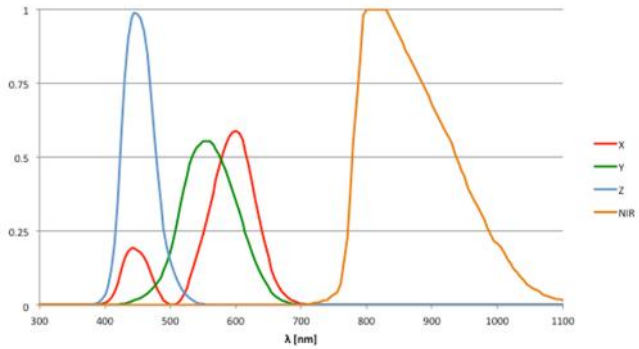


True Color Filter Set (XYZ+)

AS7225/20/21/11/61/61N Filter Set

Technology

- Long-term stable and highly accurate nano-optic interference filter technology
- 6 channels: X,Y,Z + NIR + Clear + Dark
- Based on CIE 1931 industry standard for human perception



CIE 1931 6 channels: x,y,z filters + NIR + Clear + Dark (not shown)

Example Applications

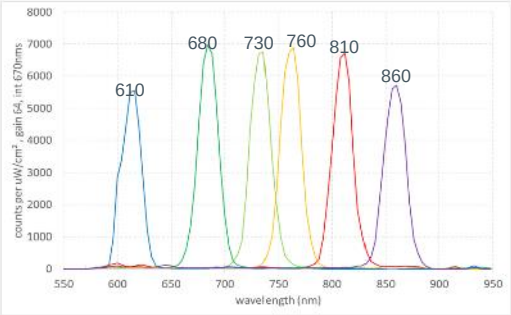
- Color Matching for industrial or consumer applications
- Active feedback control for LED lighting
- Manufacturing and process control
- Auto-calibration of displays & monitors
- Ambient light and color metering

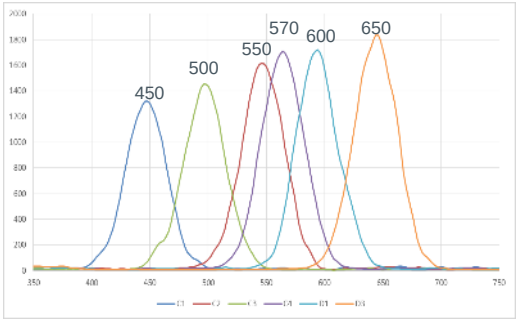
Multi-spectral Filter Set (6 Channel)

AS7263 Filter & AS7262 Filter

Technology

- Long-term stable and highly accurate nano-optic interference filter technology
- 6 channels: from 450nm to 650nm or 640nm to 860 nm as a standard product
- Customer filter sets possible at 20nm FWHM for each filter





Example Applications

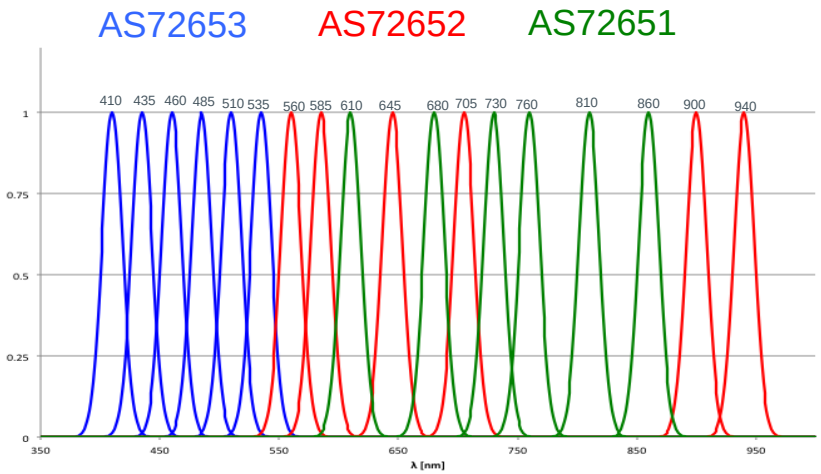
- Color matching for industrial or consumer applications
- Authentication and counterfeit protection
- Chemical fluid analysis (using reagents)
- Chemical ID marker detection
- Substance analysis for food or beverages

Multi-spectral Filter Set (18 Channels)

AS72651, AS72652 & AS72653 – Moonlight

Technology

- VIS through NIR including 900 and 940nm at 18 channel resolution
- 3 chip solution with 20nm FWHM with 6 channels per device
- Including common blocker and red organic filter



Example Applications

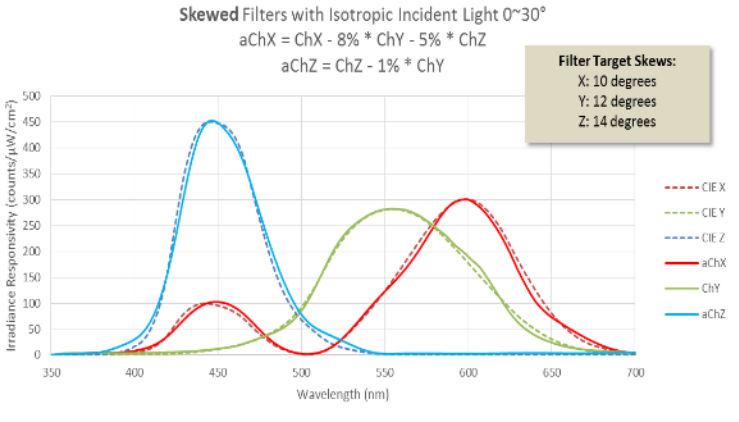
- Currency authentication
- Chemical fluid analysis (using reagents)
- Chemical ID marker detection
- Substance analysis for food or beverages
- Fruit ripeness or sweetness

True Color Filter Set

TCS3430 – Compact 5-channel high accuracy XYZ tri-stimulus color sensor

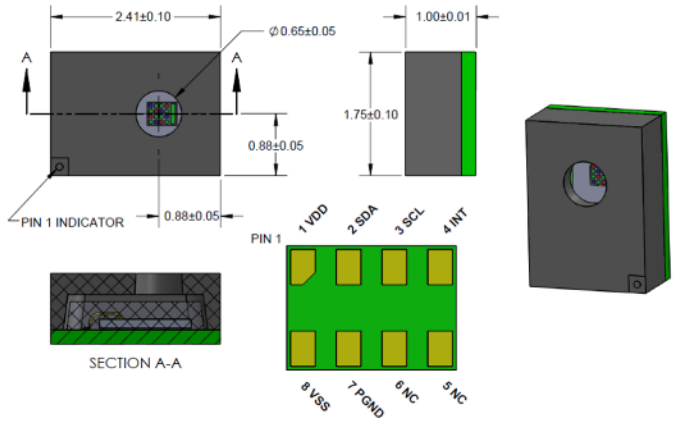
Technology

- Cost effective 5 channel X,Y,Z & 2 IR
- 4 x 4 photodiode array with interference filters for tri-stimulus visible response plus infra-red.
- Small: 1.75 x 2.41 x 1.00mm package
- Digital: I²C output with no integrated spectral engine



Potential Applications

- Color Matching for industrial or consumer applications
- Active feedback control for LED lighting
- Manufacturing and process control
- Auto-calibration of displays & monitors
- Ambient light and color metering



IR Sensors Platform

CMOS based Infrared Sensing

AS7563

IR Emitter

- Low Power
- Heater area: 0.5mm²
- TO46 or SMD
- Window Option

AS7564

IR Emitter

- High Power
- Heater Area: 3.1mm²
- TO39 or SMD
- Window Option

AS7510

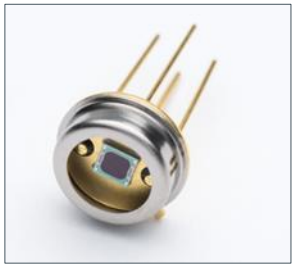
IR Detector

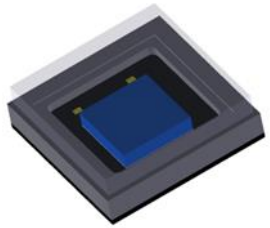
- Thermopile
- Under development
- Q3 2017

AS7500

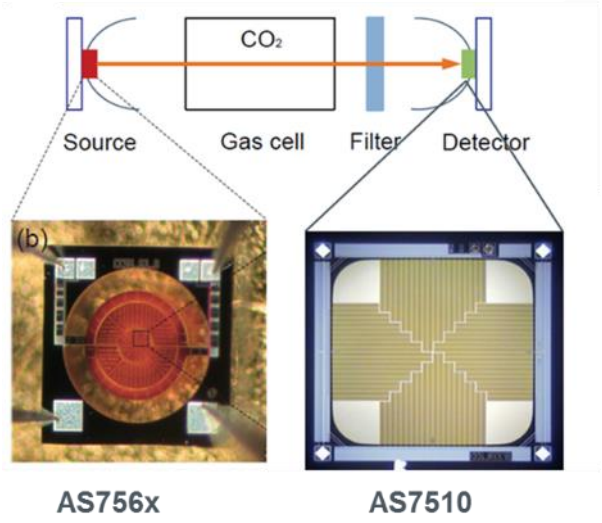
IR Detector

- Pyro-Electric
- Under development
- Q3 2017





NDIR (Non-dispersive IR) Gas Sensor

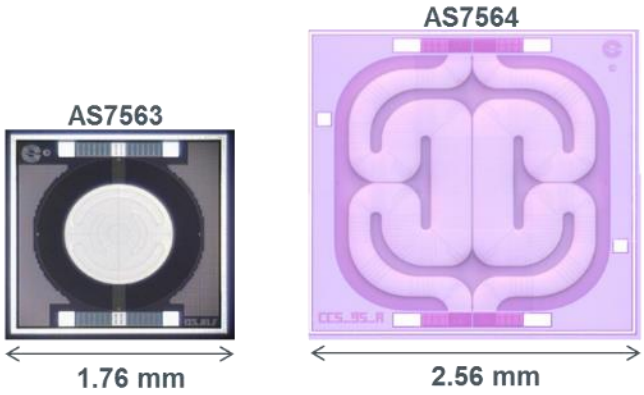


IR Emitter Family (AS756x)

AS7563 & AS7564

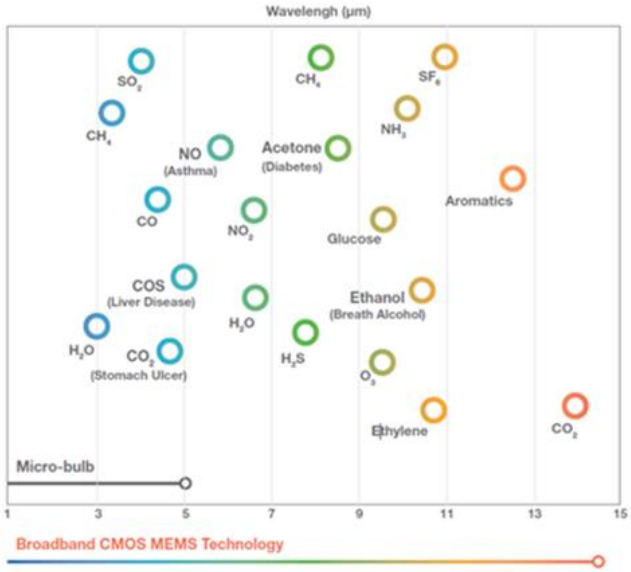
Technology

- Based on Tungsten Micro-Heater made in CMOS
- Fast response time
- Wide emission range: 2µm to 15µm
- High Emissivity achieved by plasmonic structure
  - >0.8 at 4.26µm (CO^2)
  - >0.9 at 9µm



Example Applications

- NDIR (Non-dispersive IR) Gas Sensing
- CO^2 measurement / leak detection
- Breath alcohol checker
- Toxic gas leak detection



Use Case Examples

CCT management, daylight control, color consistency over lifetime

Smart Light Management

- Full system lighting solutions on a single chip
- Sensor controlled color and daylighting, automatic lumen and color maintenance
- Network connected and sensor hub expansion options

Aviation Lighting

- Automatic optical feedback loop for aviation lighting (RGBW)
- Homogeneous mood lighting realized by customer SCHOTT®
- Product requirements set to the highest aviation standards

Display Management

- Automatic color calibration
- Automatic ambient light balancing
- Display adjustments depending on light temperature (CCT)

Use Case Examples

Color matching, fluid analysis, light metering

Color Matching

- Provides precise color identification, then uses app to lead to matching and complimentary color product choices
  (paint, cosmetics, home décor)
- BOM cost savings of over $20 to discrete solutions
- Available on Amazon

Food Freshness

- Each substance has a unique spectral fingerprint
- These can be used in fruit, vegetables, crop, etc. to determine factors such as sweetness, protein level and more.

Light Measurement

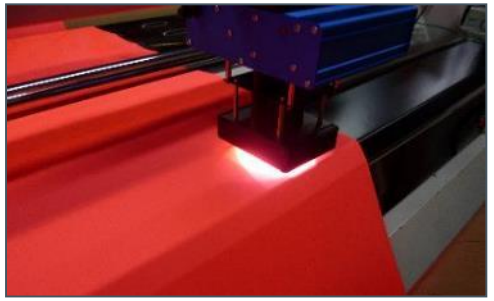
- Accurate CCT measurement with a Smart Phone peripheral device
- Combination of exposure data, lux and color temperature for photographers and film makers
- Unique products for the lighting industry with the Smart Light Manager & Smart Light Director

Use Case Examples

Inline process control, infield optical analysis, automation & quality control

Automated Surface Monitoring

- Fabric or goods analysis during manufacturing
- Enables automated pre-sorting
- Visual and spectral quality assurance significantly reduces waste of material

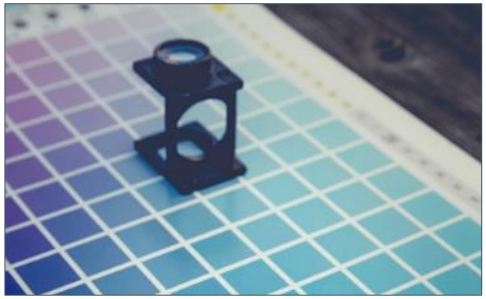


Growth Light & Agricultural Substance Analysis

- Grow light: automatic spectral adaptation towards plant needs
- Crop analysis directly on the combine or harvester
- Analysis key values like moisture, protein, starch, etc.

Inline Print Control

- Monitoring of inks and printing good changes
- Options for high speed applications
- Measuring options ink density, color (CIE 1931), spectral reflectance



Use Case Examples

Authentication, gas sensing, fluid analyis

Authentication

- Anti-counterfeit measures currency, medicine or products, etc.
- Special spectral markers IDs can be detected to determine original or fake product

Infrared Gas Sensing

- Energy from IR sources absorbed by gas have a specific wavelength
- IR detector measures energy at specific wavelength reduction in signal determines amount of gas present
- Typical applications are CO^2 detection

Fluid Analysis

- Water measurement device using active chemical reagents to “make the invisible visible”
- One sensor can be used for over 90 chemical parameters
- Parameter examples: Aluminium, Cholrine, Fluoride, pH, Nickel, etc.

NIR Spectral Sensor - Use Case Example

Determining the chlorophyll level of an apple

Harvest stage?

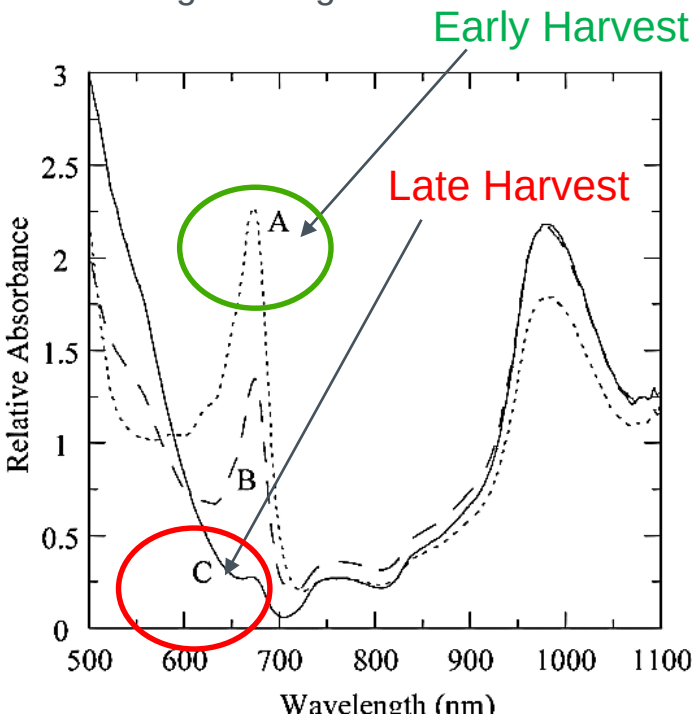
Light →

→

Desktop Spectrometer with NIR Sensor

Spectral Fingerprint

Each material (chlorophyll) absorbs specific wavelengths of light



SCC2017 - SpectroNet Collaboration Conference

Topic: Spectral Sensors and Systems for Mass-Market Applications

Dates: 30.08.-31.08.2017
Place: Moritz-von-Rohr-Str. 1a, 07745 Jena, Germany

in collaboration with Clusterpartners:
ams AG, MAZeT GmbH, Carl Zeiss Spectroscopy GmbH, AMA Verband für Sensorik und Messtechnik e.V. & Technologie- und Innovationspark Jena GmbH



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