

BROCHURE
**SPECTROSCOPY IN
AGRICULTURE & FOOD**

INNOVATION IN AGRICULTURE & FOOD

Climate change and population growth are driving fundamental changes in the agriculture and food industries. Feeding a growing population while managing resource scarcity, changing weather patterns, and soil depletion requires smarter, more sustainable practices. **Spectroscopy has emerged as a key enabling technology**, offering real-time, precise, and non-invasive solutions to these challenges.

From **precision farming and soil analysis to food quality control and supply chain transparency**, spectroscopy empowers farmers, producers, and quality control experts to make data-driven decisions. By harnessing the power of light, it enhances productivity, reduces waste, and ensures consistent product excellence—transforming every stage of the agriculture and food value chains.

At Avantes, we are proud to lead the way in spectroscopy solutions. **Trusted by industry leaders worldwide**, our state-of-the-art spectrometers and tailored advice enable seamless integration into diverse applications. One of our unique product capabilities is the high-speed data transfer our spectrometers can achieve, which is of great importance for various applications in the agriculture and food industry, such as fruit sorting and fertilizer application.

In this brochure, we explore the various applications where spectroscopy adds value to agriculture and food industries, showcasing how it drives sustainability, efficiency, and innovation. Discover the Avantes advantage, and how our expertise and cutting-edge technology can help you achieve more with less—and **shape the future of sustainable agriculture, together**.



FRUIT SORTING & GRADING

Ensuring fruit quality and consistency is critical, where precision and efficiency drive success. Spectroscopy has revolutionized fruit sorting and grading by offering non-destructive, real-time analysis of **ripeness, sugar content (Brix value), moisture levels, and even internal defects**.

Unlike traditional methods, spectroscopy provides instant, detailed insights, enabling automated sorting with unmatched accuracy. This **optimizes workflows, reduces waste, and ensures consistent, high-quality output**.

Avantes' spectroscopy solutions are specifically designed to meet the demands of these advanced applications. For example:

VARIUS™ Spectrometer NIR Enhanced:

This spectrometer contains a special NIR enhanced detector that offers up to two times higher sensitivity in the NIR range (700–1100 nm). Additionally with its high-speed data transfer, this spectrometer is ideal for integration into automated sorting lines for in-line measurements.



GREENHOUSES & VERTICAL FARMING

In controlled environments like greenhouses and vertical farms, light is a critical factor influencing crop growth, yield, and quality. Plants respond to the quantity, quality, and duration of light, which drives processes like photosynthesis and the production of compounds that affect flavor. Spectroscopy provides detailed spectral data on the quality and intensity of light received by plants, allows growers to fine-tune lighting systems and create ideal growing conditions.

Avantes' spectrometers are integral in applications such as:

LED Optimization: Determining the ideal mixture of light wavelengths to maximize plant growth and development.

Daily Light Integral (DLI) Management: Automatically adjusting shading systems or artificial lighting to ensure plants receive the optimal amount of light throughout the day.

(Extended) Photosynthetically Active Radiation Measurements: Monitoring the light intensity in the 400–750 nm range to ensure plants receive the necessary energy for photosynthesis.

Avantes' solutions are designed for seamless integration into greenhouse and vertical farming systems, empowering cultivators to make data-driven decisions that ensure sustainable and productive operations.

SOIL ANALYSIS & MANAGEMENT

Soil health is the foundation of sustainable agriculture and food production. Accurate, real-time data on soil composition empowers farmers, agronomists, and researchers to make informed decisions that optimize yields, conserve resources, and enhance food security.

Spectroscopy provides a powerful, non-invasive method for **analyzing key soil properties such as nutrient levels, organic content, moisture, bulk density, and compaction**. This detailed insight enables more precise soil management practices, improving efficiency and sustainability across agricultural operations.

At Avantes, we specialize in delivering tailored spectroscopy solutions, from custom-designed optical benches to specialized fiber-optic probes, ensuring you have the tools needed to meet your unique challenges. **Our instruments are designed for seamless integration into soil analysis workflows**, offering the accuracy and reliability essential for modern agriculture.

When you choose Avantes, you gain more than advanced spectrometers — you gain a partner committed to helping you unlock your soil's full potential. Together, we can cultivate a sustainable future through smarter, data-driven decisions.



PLANT HEALTH ANALYSIS

Plant health directly impacts crop yields and agricultural profitability. Near-Infrared (NIR) spectroscopy has been implemented as a powerful, non-invasive tool for monitoring plant health. By analyzing the absorption and reflection of near-infrared light, NIR spectroscopy provides valuable insights into the chemical and physical properties of plants.

This advanced technology enables farmers to:

Detect plant diseases early, such as Rice Blast Fungus, reducing yield loss through timely intervention.

Assess crop parameters to optimize fertilizer use and improve efficiency.

Identify bruising and stress in plants that are invisible to the human eye.

For example, researchers have successfully used NIR spectroscopy combined with neural networks to detect rice blast disease at large scales, identifying changes in spectral reflectance to monitor disease severity. **This approach reduces reliance on manual inspections, making crop management more efficient and sustainable.**

Avantes spectrometers provide the precision and reliability needed for plant health monitoring applications, offering tailored solutions to meet the demands of modern agriculture. With our technology, farmers can adopt smarter, data-driven practices to safeguard their crops and maximize yields.



INTEGRATION INTO YOUR APPLICATION

At Avantes, we specialize in providing tailored spectroscopy solutions for seamless integration into handheld devices and agricultural systems. Whether you need a custom optical bench or a modular OEM solution, our collaborative approach ensures your unique requirements are met with precision and reliability.

Spectroscopy in handheld devices

Handheld devices are transforming agriculture by delivering real-time data directly in the field. Using reflectance, absorbance, and transmission spectroscopy, portable tools monitor plant health, detect diseases early, and optimize nutrient management. Our compact spectrometers are ideal for integration into handheld devices.

Spectroscopic modules for agricultural machinery

A great example of integration into agricultural machinery is the Yara N-Sensor. Mounted on tractors, it uses diffuse reflection to assess crop chlorophyll levels and provide health scores that adjust fertilizer application in real-time, supporting sustainable soil management.

From collaboration to rigorous testing, Avantes ensures every solution meets the highest standards of performance and reliability. Empower your operations with innovative spectroscopy systems designed to improve efficiency and sustainability.

SPECTROMETERS

Since spectroscopy is used for numerous applications, we have defined our spectrometers in different lines.



NEW: NIR
ENHANCED
COMING SOON

CompactLine

Compact
Easy integration
CMOS detector
2048 or 4096 detector
190-1100 nm
NIR-version available
900-1750 nm
USB powered



NEW: NIR
ENHANCED
COMING SOON

StarLine

High-performance
General applications
Stray light rejection
2048 or 4096 detector
190-1100 nm
High resolution
Improved sensitivity
USB powered



SensLine

High-sensitivity
Demanding applications
Low noise
Ultra-high resolution
200-1160 nm
Stray light rejection
High stability
Uncooled available



NIRLine

High-performance
Cooled & uncooled
Cooling to -25 °C
For harsh environments
900-1750 nm
Enhanced stability
Low noise
Compact option available

Products are available in industrial housing for smooth integration.

Visit www.avantes.com/products to see all available products.

PRODUCT PORTFOLIO

Beside spectrometers, we offer a wide range of products to complete your measurement setup.

Light Sources

Avantes' light source options include deuterium, tungsten halogen, and LED for spectral ranges from 190 – 2500 nm. The AvaLight line consists of several calibration sources for irradiance and spectral line calibrations. All light sources are fiber optic coupled with SMA connectors.

Fiber Optics

We offer an extensive line of fiber optic cables, bundles, and probes. Our in-house production facility manufactures fiber optics for deep UV, UV/VIS, and VIS/NIR applications using high-quality silica fibers. Custom configurations for fiberoptic reflection, absorption, and fluorescence probes are always negotiable.

Software

AvaSoft software is a 32 and 64-bit compatible application-oriented software package that enables complete control over our spectrometers. Application-specific software solutions are available. Our in-house engineers can work with customers to support standard and custom application needs (DLL).

Accessories

We offer a wide range of fiber optic coupled sampling accessories such as cuvette holders, integrating spheres, filters, filter holders, and flow cells. In addition, Avantes offers a variety of fiber optic accessories, including collimating lenses, cosine correctors, and vacuum feedthroughs.



DISCOVER MORE APPLICATIONS

Discover more application examples, or download our precision agriculture eBook, showcasing how spectroscopy is transforming the agriculture and food industries. Scan the QR codes below.



Precision Agriculture eBook



Detect Fat in Milk with NIR Spectroscopy



Soil Analysis with LIBS



Tryptophan Detection in Turkey and Milk

WHY PARTNER WITH AVANTES

Proven expertise:

With over 30 years of experience, Avantes is a global leader in fiber-optic spectroscopy instruments and systems, trusted by industry professionals worldwide.

Global reach, local support:

Our extensive network of distributors and partners ensures you receive local expertise and support.

Tailored solutions for every application:

We specialize in creating customized solutions tailored to the specific needs of your application.

Innovative products:

We continually work on innovating new products, such as the versatile VARIUS Spectrometer, which offers unmatched flexibility and power for a wide range of applications.

Comprehensive support & training:

We empower our customers by supplying comprehensive support, helping them fully utilize the potential of our products.

By partnering with Avantes, you gain a trusted ally dedicated to innovation, quality, and sustainable solutions that meet your unique needs.

ABOUT AVANTES

Avantes is a global leader in the compact spectrometer industry, serving a wide range of industries, including agriculture, food, (bio)medical, and consumer electronics. Our instruments are trusted in world-class research laboratories, integrated into devices, and play a vital role in quality control during production processes.

With decades of experience working with diverse applications, Avantes is a trusted partner for clients seeking tailored solutions for their specific measurement needs. From our headquarters in the Netherlands and offices in the USA and China, our sales engineers collaborate closely with customers to deliver the ideal spectroscopy solution.

Additionally, our global network of distributors in over 35 countries ensures local expertise and support wherever you are. Every Avantes product is proudly designed and manufactured in our state-of-the-art facility in the Netherlands.

Curious how our solutions can support your application?

Visit our website or reach out to our technical support team—we're here to help!



SUPPORT & ADVICE

Providing high-quality equipment is only part of what we do. The other equally important factor is the high level of service we deliver. Our organization includes various specializations to provide you with the best service and advice:

Feasibility studies

Our sales engineers perform free feasibility studies to find your most ideal measurement setup.

Support team

Our team of technical experts is always ready to support you.

Demo program

Our demo program allows you to try our products for free to ensure you find the perfect solution.

MyAvantes

A personal platform where you'll find AvaSoft Software and other helpful material for you to download.

Online support

Helpful documents and tutorial videos for extra help with your products.

Curious what we can do for your application?

Visit www.avantes.com/contact or scan the QR-code to contact us



CONTACT

WE'RE HAPPY TO HELP

Curious how spectroscopy can help you reveal answers by measuring all kind of materials, in-line, at your production facility, in a lab or even in the field? Please visit our website or contact one of our technical experts, we're happy to help you.

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