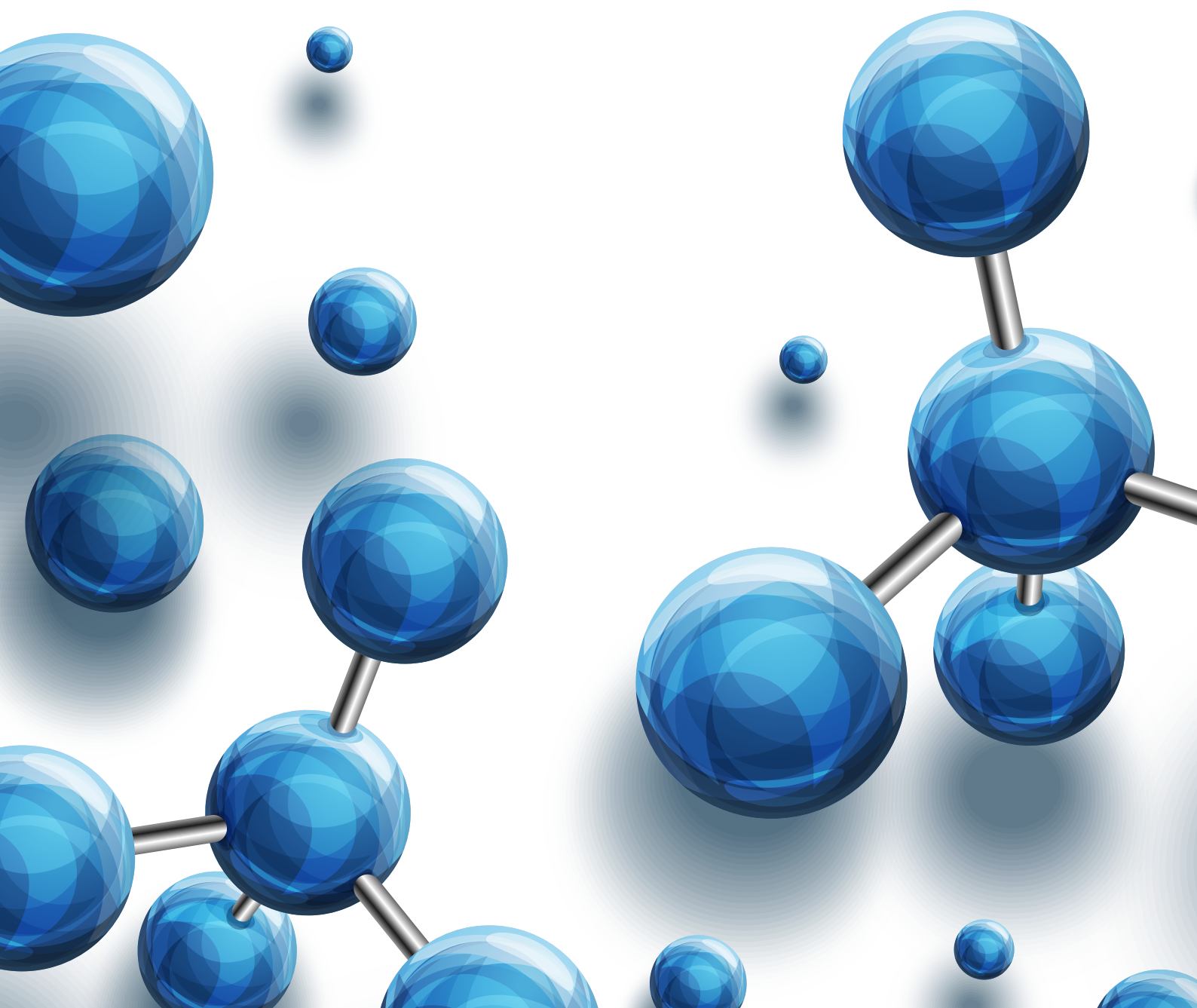


BROCHURE

# RAMAN SPECTROSCOPY

IDENTIFYING THE UNKNOWN





## RAMAN SPECTROSCOPY

Raman spectroscopy is a molecular measurement technique that characterizes the inelastic scattering of photons in covalently bound molecules. This scattering is then used to **define what is known as the material's molecular fingerprint, crystallinity, and other specifications.**

Because each material has a unique Raman spectrum, it is an ideal technique to identify and qualify the compositing and presence of substances.

In its early years, Raman was only found in laboratories, but this technique is now widely used in the spectroscopic community. It provides an invaluable analytical tool for molecular fingerprinting and monitoring changes in molecular bond structure (state changes, stresses/strains).

Nowadays, you can find Raman in applications ranging from airport security screening to medical and high-end university research.

At Avantes we have almost 30 years of experience in the development of empowering spectroscopy solutions and will guide you in finding your Raman setup.

## RAMAN & AVANTES

With a wide variety of Raman products available it can be difficult to find a company that matches the needs for your application. Why Avantes is the right partner for your Raman setup? We happily explain why:



### In-house Development & Partnership Approach

Our headquarters in the Netherlands houses a state-of-the-art manufacturing facility. It is our global center of designing and manufacturing our products and software. With all this in-house knowledge, we can follow a methodical needs analysis and solution definition process, together with you to ensure we develop a solution that perfectly aligns with your needs.



### TE Cooling

All AvaRaman spectrometers have a Peltier cooling system, that provides  $\Delta T$  down to  $-35^{\circ}\text{C}$  cooling to ambient for superior dark noise reduction, keeping the detector at a steady  $5^{\circ}\text{C}$ . This temperature is stable within a  $0.1^{\circ}\text{C}$  bandwidth, thanks to the PID controller. The TEC cooling enables the use of longer integration times to enhance detection of small signals.



### Optical Bench Design

Our spectrometers are developed with a symmetrical Czerny-Turner design. Light enters the optical bench through a standard SMA-905 connector and is collimated by a spherical mirror. A plain grating diffracts the collimated light after which a second spherical mirror focuses the resulting diffracted light. An image of the spectrum is projected onto a 1-dimensional linear detector array.

# SPECTROMETERS

To ensure you find your most ideal Raman measurement setup, we created multiple setups for you to choose from.

## AvaRaman Bundles



We joined forces with two partners to offer you [three Raman bundles](#). All bundles consist of a **high-performing spectrometer, a unique laser-probe combination, and our Raman Software**. The Highsense Bundle has a higher quantum efficiency in NIR and better signal to noise performance. For weak Raman signals we recommend the Performance Bundle. When strong signals are available, the Basic Bundle is the right pick.

**Highsense Bundle:** For the most challenging applications. This bundle uses the AvaSpec-Hero for detection. The high-end cooled backthinned detector, low-noise electronics and optical bench with high Numerical Aperture, results in excellent Signal to Noise and Dynamic Range.

**Performance Bundle:** For demanding applications. Cooling enables you to work with longer integration times, yet keeping the thermal noise limited.

**Basic Bundle:** For basic applications. Based on an uncooled spectrometer this is the entry bundle for reasonable strong signals.

## AvaRaman

The [AvaRaman](#) contains a high-sensitivity spectrometer and a 532 nm or 785 nm laser to give you the best result for your measurements. The system is appropriately configured according to the wavelength of the laser. The power of the laser source is adjustable via software.

We integrated our AvaSpec-HERO into the system. Due to the lower dark noise the performance upgrades. The superior signal-to-noise ratio (800:1) is important when you're dealing with small signals. The higher NA optical bench results in a better sensitivity. **This will lead to more photons impinging on the detector.**

AvaRaman is available in three options, all containing a TE cooled spectrometer to provide accurate and reproducible results. The difference in these options is in the signal to noise ratio, resolution, raman shift, laser output, wavelength and bandwidth.

### Technical data:

Click this [link](#) to discover all technical data of the **AvaRaman and AvaRaman Bundles**



# LASERS & PROBES

## Lasers

Our lasers are ideal for Raman due to their narrow bandwidth ( $<0.1$  nm): an exact wavelength is critical for the correct excitation of molecules. In addition their drift fluctuation is low: under 0.25% over a period of 8 hours, which is perfect for reaction monitoring. The lasers are available in various wavelengths.



## Probes

Special Raman probes are available for both fluids and solid substances. They feature different focal lengths, special versions for high temperature and/or high pressure are available. They are optimized for various specific excitation wavelengths. We offer four probe variations:

Raman-PRB	Raman-PRB-FP	Raman-PRB-FIP	Raman-PRB-FC
3/8" SS focusing probe, 200 $\mu$ m excitation fiber, 400 $\mu$ m read fiber. It can withstand 80°C. Manual shutter included, 1.5 m fibers. Spotsizes at sample 90-140 micron. Multiple focal lengths available.	1/2" SS focusing probe, 200 $\mu$ m excitation fiber, 400 $\mu$ m read fiber. It can withstand 80°C. Spotsizes at sample 90-140 micron. Multiple focal lengths available.	5/8" SS immersible focusing probe for in-situ measurements, 200 $\mu$ m excitation fiber, 400 $\mu$ m read fiber. It can withstand 200°C. Spotsizes at sample 90-140 micron.	3/8" SS immersible process probe for in-situ measurements, 200 $\mu$ m excitation fiber, 400 $\mu$ m read fiber. Withstands 500°C and 3000psi. The probe optics provide background filtering. Spotsizes at sample 90-140 micron.

# SOFTWARE

Our in-house designed software, **AvaSoft-Raman**, enables full control over your Raman spectroscopy system and is included into your system. In addition to most features of AvaSoft-Full, it also features:

- Auto-calibration routines to determine the excitation laser peak (calibration tile is needed, sold separately)
- Integration of time progress bar to indicate integration time status for longer spectral acquisitions
- View signal in normalized counts
- Software baseline correction for fluorescence suppression
- Process control add-on module is available for online analyses and control.

Also available is **Panorama© software**, a sophisticated modular spectroscopy software platform for end users who require special analytical functions. It enables manipulation of all 2D and 3D spectroscopic data with just a few mouse clicks. It also features mathematical noise reduction, functional group assignment and advanced reaction-monitoring capabilities.

Panorama Light© software is a slim version of Panorama© which is only available in combination with our AvaRaman bundles. It offers:

- 2D & 3D data visualization
- Searching in libraries
- Archiving in spectral libraries, including additional information
- Conversion of many known data formats



# RAMAN APPLICATIONS

Spectroscopy is used in hundreds of applications across dozens of industries, with new uses found every day. Below we show you a few application examples to get a glimpse of the endless possibilities Raman spectroscopy has to offer.

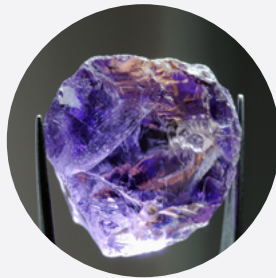


## Agriculture & Food

The agriculture & food industry relies heavily on spectroscopic measurements. Because Raman can measure solids, liquids, or gases you can imagine the possibilities in this industry. Think about applications like meat quality control, process control in food sorting or detecting bacteria in eggs or milk.

## Biomedical

Raman spectroscopy has been shown to have massive potential for point-of-care medical diagnostics and monitoring. Applications in this industry are endless and range from cancer boundary detection during surgery to blood analysis.



## Gemology

In the gemology industry it is crucial to characterize and identify the gemstone you are working with. Raman spectroscopy provides molecular and atomic composition of the gemstone. With Raman you can distinguish the difference between natural and lab-grown gemstones, but also detect counterfeits.

## Security

Raman spectroscopy is a common measurement technique used in the security industry. Applications you can think about are explosive detection, material analysis at the airport, detection of narcotics, forensics analysis and chemical trace sensing.



## Recycling

Recycling has become an important subject in today's society due to the impact of waste on our environment. Raman is used to research the development of alternative high-storage capacity technology, identify materials for recycling and more.

## More application examples

Click this [link](#) to read more application examples



# AVAMATION: FUTURE-PROOF MANUFACTURING

There is a worldwide increasing demand for spectrometers. More and more customers purchase in large volumes, which means the performance of each spectrometer must be exactly the same.

We manufacture our spectrometers using AvaMation, our semi-automated manufacturing process. We innovated this process to increase efficiency and precision to be ready for a future with an increasing demand of spectrometers.

This new way of manufacturing not only benefits Avantes when it comes to efficiency, but also yields the following benefits for our customers:

## WHAT'S IN IT FOR YOU?



### **Scalable manufacturing capabilities**

From small, up to very high volume orders, with AvaMation we are very flexible when it comes to customizing orders.



### **Superior inter-instrument reproducibility**

Through AvaMation we not only take quality assurance to a higher level, but also provide more manufacturing precision and speed.

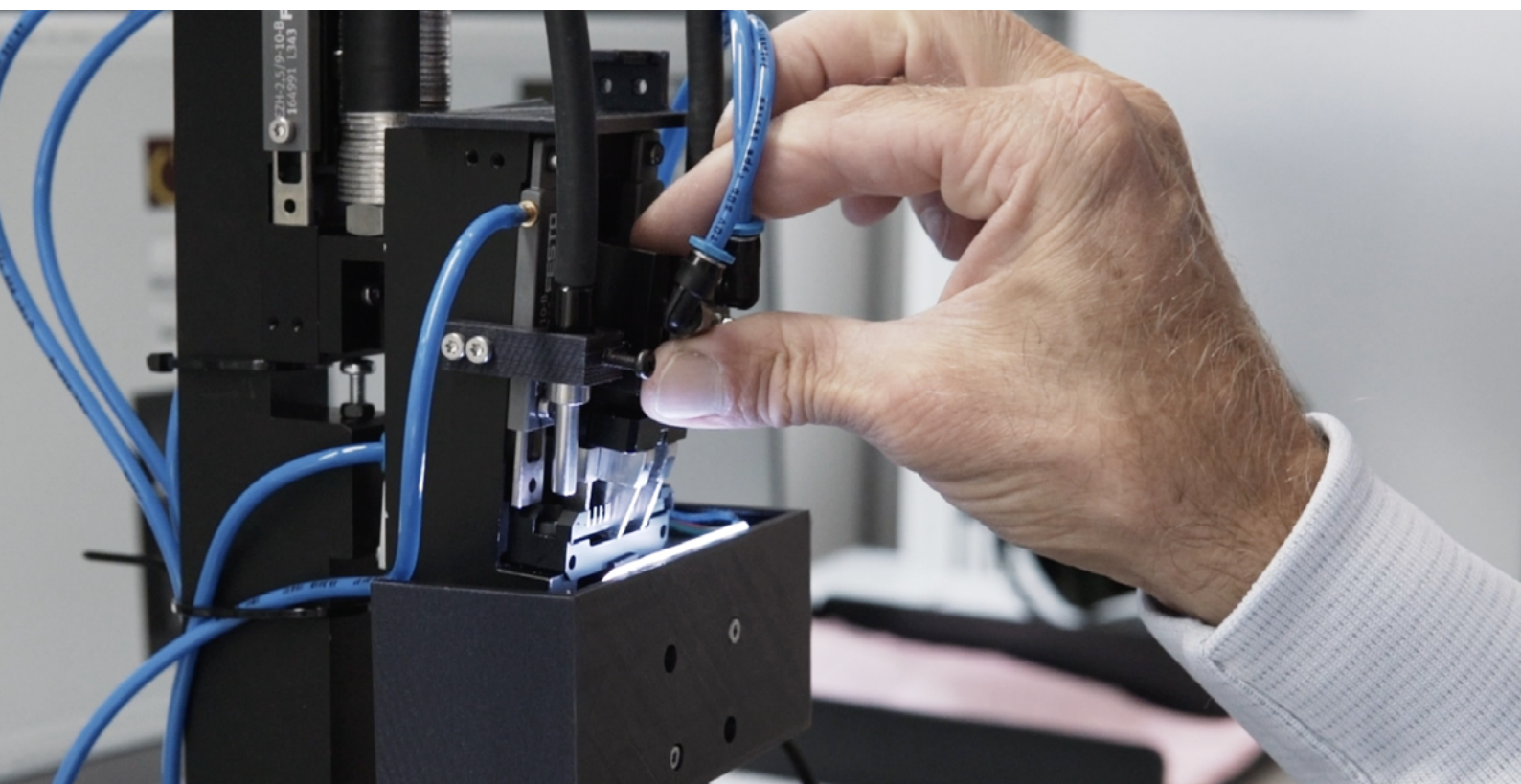


### **Enabling data analysis**

By collecting data from the manufacturing process, we can continue to innovate and make product improvements in the future.

## **More information:**

Click this [link](#) to discover more about AvaMation.



## 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 support team never sleeps and provides you with the best service.

### Demo program

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

### MyAvantes

Personal platform where you'll find AvaSoft Software and other material for you to download

### Online support

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



## ABOUT AVANTES

We are Avantes, a leading player in the field of spectroscopy. We operate in various industries; from (bio)medical and agriculture to semiconductor and consumer electronics. Our instruments are found in world-class research laboratories, are embedded in devices, or play a crucial part in quality control during production.

With a long history of consulting with clients across diverse industries and applications, Avantes is an experienced partner, equipped to guide customers who want a solution tailored to their application and research needs. Through our headquarters in the Netherlands and offices in the USA and China, our sales engineers work closely with our customers to find the most ideal measurement solution. In addition to our direct offices, Avantes has a worldwide network of distributors in over 35 countries who are ready to assist you. All of our products are made in our own production facility in the Netherlands.

Curious how our solutions can empower your application? Visit our website or contact our technical support. We are happy to help you!

**Curious what we can do for your application?**

Click this [link](#) to contact us directly.





## CONTACT

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# 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.

### Avantes Headquarters

**Follow us on social media:**

