PHOTONICS NEWS

Company Newspaper of LASER COMPONENTS Nordic AB

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BIO & AGRICULTURE

Durable Oranges

Optical Oil Analysis

Precise Fertilization

Atmospheric LiDAR

New Products

Editorial

Dear reader,

Photonics play an important role driving innovation across a variety of industries. One such field is agriculture, in which the technology is applied to overcome new challenges and increase productivity and quality. Photonic technologies can help predict fungal infestation in fruits, determine the amount of nitrogen the grain requires, and analyse authenticity of ingredients to protect against food fraud. In this issue of Photonics News, we highlight intelligent farming and how photonics are used to change the agricultural sector in terms of sustainability and resilience.

In recent months many of us had to face a different kind of radical change caused by the surge of COVID-19 pandemic. Nevertheless, while the crisis unfolds, we should prepare for what is coming next. The new reality taking shape is made of complexity, uncertainty and opportunities. At LASER COMPONENTS it is important to us that we stick to our long-term goals despite the incalculable extent of the pandemic. We are using this quieter time to develop new products and technologies. In addition, extensive investments have been completed or initiated in recent months.

First and foremost, we proudly want to inform about our new production facility in Chandler, Arizona. The almost 3,000 m^2 building is used for the development and production of avalanche photodiodes and infrared detectors, the demand for which has multiplied in recent months. For this purpose, state-of-the-art temperature- and humidity-controlled clean-rooms of class ISO7 (10,000 according to US standard FED-STD-209E) with airtight passages and an air shower were installed. The new factory provides space for 60 employees working in a single shift and up to 200 employees working in three shifts. With this ultra-modern building, we are able to meet the rapidly increasing demand for our technologies and support our customers´ growth.

We have also invested diligently at our production site in Germany. For example, another large ion beam sputtering coating system for producing high-quality laser optics will soon be put into operation. Additionally, a completely revised concept for the measurement of single-photon counters is now available which will increase production capacity and flexibility for our COUNT modules.

Enjoy reading! Yours,

Fredrik Wikfeldt, CEO
LASER COMPONENTS Nordic AB

Content

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Imprint

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How Do Fruits and Vegetables Stay Healthy?

The quality control of agricultural products does not end with their harvest. This is especially true for fruit and vegetables that are not directly processed because the condition of the fruit changes during storage and transport. During harvesting, the fruit is separated from the plant, and therefore no longer receives water and nutrients. At the same time, more water is lost through evaporation: a decay process begins that makes the goods more susceptible to pests and ultimately spoiling. Researchers are looking for ways to assess the "state of health" of fruits and vegetables quickly and automatically in order to keep the yield of harvested food as high as possible. ➔

More Accurate than the Human Eye

Researchers Examine the Skin of an Orange Peel

The mold *Penicillium digitatum* is considered one of the greatest enemies of citrus fruits. In many regions in which citrus fruits are grown, it is the main cause of spoilage during storage and transport and accounts for around 90% of all losses. It attaches itself to small damaged areas of the peel, through which water and nutrients escape. Initially, a soft spot develops on the surface, which resembles a pressure point. From there, white mold tissue

One moldy orange
can spoil an entire crate.

spreads across the entire fruit, which eventually turns green as the fungus begins to form spores. In the end, all that remains of the fruit is an empty, dry peel. A single infested orange can quickly spoil an entire crate. By the time the fungus has developed its white mycelium and is visible to the naked eye, it is already too late. That is why a method has long been sought to detect a fungal infection as early as possible. Researchers from the *Leibniz Institute of Agricultural Engineering and Bioeconomy (ATB)* in Potsdam and the *Valencian Institute of Agrarian Research (IVIA)* are now examining oranges using laser light.

Manual inspection is
complex and subjective.

© istock.com/Tim UR

In Darkened Rooms

There are methods available for testing fruit with respect to defects, pests, and many other factors after harvest. One common method includes manual inspection, in which trained personnel examines each individual piece of fruit looking for certain characteristics. In the case of oranges, for example, examination is carried out in darkened rooms under UV light, which causes escaping essential oils to glow. This allows damaged fruit to be identified and sorted out. This process is just as time-consuming and laborious as it sounds. In addition, there is a risk that employees can be exposed to harmful UV light. You can also find out a lot about fruits and vegetables in a chemical laboratory; however, chemical methods are usually destructive. The fruit is destroyed in the process; thus, it is only possible to perform spot checks. This is not a problem when, for example, the average degree of ripeness of a banana cluster needs to be determined. However, the rotten fruit in a box of oranges can only be discovered in this way by chance. It is, therefore, important to find a fast, reliable, and non-invasive method that can be used, for example, to automatically sort out defective fruit in a sorting plant.

Measuring the Backscatter

ATB researchers test the methodology of so-called optical imaging backscatter measurements: The experimental setup consists of five dot laser modules with wavelengths of 532 nm (green), 660 nm (red), 785 nm, 830 nm, and 1060 nm (near infrared). The fruit is irradiated, alternating between one or more of these lasers. The light is reflected in two different ways. The first reflection is the classic Fresnel reflection, in which the photons are reflected at the surface of the sample. The second reflection, the so-called diffuse reflection, is much more interesting to scientists. This reflection provides information about the proportion of light that penetrates the sample. In the sample, the light interacts with the inner parts of the fruit before it is scattered back to the tissue's outer surface. In addition to the absorption properties, other important information about the morphology and tissue structure of the fruit can be determined. To achieve accurate results, the light must penetrate as deeply as possible into the fruit. Therefore, scientists require particularly powerful laser modules. A monochrome CCD camera is used for evaluation, which provides researchers with detailed information on the propagation of the light inside the fruit.

From this information they can draw conclusions about a possible fungal infection.

Best Results with Visible Light

In the case of *Penicillium digitatum*, cell fluid accumulates outside the cells in the so-called apoplast. This changes the reflection behavior compared to healthy fruits. With optical measurement technology, a fungal infestation can also be detected in oranges that appear completely undamaged to the naked eye. Scientists at ATB and the Instituto Valenciano de Investigaciones Agrarias were able to prove this in their experiment at all wavelengths tested. They achieved an average success rate of around 80% even at 532 nm. This "hit ratio" increased with the number of different wavelengths that were added simultaneously. Using all five wavelengths at the same time, the average success rate was 96%; IR lasers made only a small contribution to the increase in efficiency. Scientists attribute this to the fact that visible light has a better signal-to-noise ratio due to its slightly higher scattering coefficient. In addition, NIR radiation is particularly strongly absorbed by water and carbohydrates. However, the concentration of these substances can also fluctuate strongly regardless of an infection.

Backscatter measurements make infestation visible early.

New Solutions Are Needed Urgently

The findings of the study could have a dramatic effect on the cultivation of oranges in the future. To date, the peels of citrus fruits have been treated after picking with a wax that contains fungicides and other chemicals. However, new findings and a change in public perception mean that citrus growers are now urgently looking for more environmentally friendly methods that keep the harvesting yield as high as possible. The optical method would certainly be a cost-effective alternative for sorting out infested fruit early on. However, several years will probably pass before research develops technology suitable for mass production. ■

Environmentally friendly procedures are urgently needed.

Dr. Manuela Zude-Sasse studied chemistry and held postdoctoral positions in the USA and France. Since 2007 she has been working as a research group leader for Precision Horticulture at the Leibniz Institute of Agricultural Engineering and Bioeconomy e.V., Potsdam (ATB).

After physico-chemical oriented studies at the University of Applied Sciences, **Christian Regen** has been working as a test engineer at ATB for more than 10 years and is responsible for the construction and programming of test benches.

https://twitter.com/Prec_Hort

On the Trail of Counterfeiters

Spectroscopy in Food Safety Applications

There is hardly a foodstuff that counterfeiters do not use to scam customers. They have various tricks, the most common of which is to mix high-quality varieties with cheap alternatives to increase profits. The best-known example of this is certainly the horse meat scandal of 2013; however, scam artists also like to use this method for fish. There is also often cheating when it comes to information on geographical origin and production methods because if conventionally produced cheaper goods are sold as organic products, there is a great deal of money to be made. A third widespread way to mislead the consumer is to give false information about ingredients. For example, if it says on the packaging that a product is rich in omega-3 fatty acids, then these should also be found in the contents.

Criminal Manipulation

At the top of the counterfeiters' popularity list is olive oil. A veritable cult has developed in recent years around the "extra virgin" quality seal, and consumers are prepared to dig deep into their pockets for high-quality oil. Counterfeiters have the potential to yield high profit margins and are for the most part truly audacious. In May 2019, a counterfeiting ring was discovered in Italy that makes around eight million euros in profits every year; however, the product had very little to do with olive oil. Rather, the oil sold was cheap soybean or sunflower oil, to which chlorophyll and artificial flavorings were added in order to achieve the characteristic color and spicy-bitter taste of olive oil. Every few weeks, over 20,000 liters of the adulterated substance were delivered to restaurants and stores in Germany. The production cost just 1.20 euros per liter. The oil was sold for 5 to 10 euros.

Everything from label fraud to brazen forgery is included.

Insufficient Specifications

The quality criteria for olive oil was established early on throughout Europe. In the directive EC 2568/91, the EU also recommends various methods of analysis. However, the procedure proposed in the directive has a crucial disadvantage, according to Dr. Christian Gertz from the Maxfry company: "The standard methods listed in the directive are limited to identifying certain markers that indicate manipulation. Counterfeiters are also aware of these criteria and can adapt their products to meet the limit values. Furthermore, other deceptive practices such as false declarations of origin cannot be detected. A high level of security can only be provided by a solution that evaluates a sample in its entirety."

Molecular Fingerprint

The Maxfry company, which is located in Hagen, North Rhine-Westphalia, has developed a process that detects manipulated olive oils with a probability of over 95% – and in a very short time. The basis for this information is provided by data collected with a Fourier transform NIR spectrometer from the Bruker company.

Olive oil without a single olive.

Most molecules absorb light in the infrared region of the electromagnetic spectrum and convert this energy into molecular vibrations. Since each molecule is constructed differently and has characteristic vibrations, different ranges of IR radiation can also be absorbed. A spectrometer measures the absorption as a function of wavelength and can thus create a "molecular fingerprint." This makes it possible to

precisely determine numerous organic and inorganic compounds. For a long time, this method was very complex because each wavelength had to be evaluated individually. This changed with the advent of FTIR and FT-NIR spectroscopy: With these spectroscopic methods, light is guided via continuous broadband sources first through a classic Michelson interferometer and then through the sample. The detector

FT-NIR analysis works fast and reliably.

first puts out an interferogram in which all the components of the different wavelengths are summed. This contains all the spectrometric information about the sample. In order to determine the information of the individual wavelengths, the Fourier transformation is performed. This complex calculation is done by a powerful computer, which simultaneously analyzes the spectrum using calibrations. An instrument like the Bruker MPA thus provides all the key figures for a detailed evaluation of the tested olive oil within a very short time.

Complex Evaluation

The taste and quality of olive oil depend on a complex interaction of many factors. One of the most important aspects is the content of free fatty acids. Immediately after harvesting, this content is very low in the olives (approx. 0.1 %). Due to biochemical processes, the value increases relatively quickly during storage. It is best if the fruits are pressed immediately after the harvest and contain few free fatty acids. Furthermore, the ratio of glycerides can be measured. The proportion of 1,2-diglycerides is above 90% immediately after harvest and decreases during storage because the substance is converted into 1,3-diglyceride during the production of free fatty acids. Another important factor is the peroxide number. A high peroxide value is considered an indication of natural, unrefined oil. In addition to these three examples, Maxfry's experts evaluate numerous other factors, such as fat composition and iodine content. They compare the criteria determined with the reference data of over 100,000 known samples. It is not the individual markers that is crucial here but rather their complex relationship to one another. This makes it possible to not only determine the various taste nuances (fruitiness, bitterness, spiciness, and the harmony of these three aspects) but also to make a prognosis about the origin of the oil tested. At the end of the analysis, manipulated olive oils can be identified at a rate of accuracy of more than 95 %. In addition, quality, sensory profile, and defects are categorized according to international limits. Thanks to FT-NIR spectroscopy, the necessary data is available after a single measurement process that takes less than two minutes. ■

Counterfeiters are smart and flexible.

You can recognize quality by looking at the ingredients.

A High-tech Way to Protect the Environment

Need-based Fertilization through "Smart Farming"

Plants cannot grow without nitrogen. It is an important component in the formation of amino acids and nucleic acids. It is also needed to form the pigment chlorophyll, which plays a crucial role in plant metabolism. Although a large part of the Earth's atmosphere is made up of nitrogen, a large amount of energy is required to separate the atoms of the N_2 molecules from each other. Plants therefore absorb the nitrate (NO_3^-) found in the soil, which allows nitrogen to be more easily dissolved. Later it is returned to the soil via rotting organic matter: this includes, for example, dead plant parts and the excrement of animals that have in turn feasted on the plants. Nitrate that remains in the soil is decomposed there by anaerobic bacteria and re-enters the atmosphere as nitrous oxide (N_2O) and gaseous nitrogen; or it is flushed out and ends up in groundwater. Laughing gas is considered a dangerous greenhouse gas, and high nitrate concentrations in water pose a health risk because it is converted into carcinogenic nitrite in the body.

The Nitrogen Dilemma

Farmers are faced with a dilemma in plant cultivation: on the one hand, they want to promote plant growth and must ensure that the soil contains enough vital nitrate. On the other hand, they want to work in an as environmentally friendly way as possible and avoid harming the atmosphere and groundwater. They can only achieve both if they always know exactly how much

How can you control the nitrogen concentration based on need?

nitrogen the grain currently requires. To make matters worse, the area under cultivation is not a homogeneous mass that is produced in a laboratory; instead, the nitrate concentration of the soil can sometimes vary from one square meter to the next. The yield is correspondingly irregular. In conventional agriculture, an average amount of fertilizer is usually ascertained, which is then spread across the entire field. The trick is to keep the proportion of over-fertilized and under-fertilized areas as low as possible.

The Right Green

So-called "sub-area-specific inventory management" aims to solve this dilemma. This involves determining the condition of the soil and the plants in as small a scale as possible and dynamically adjusting the quantity of fertilizer to meet current requirements. Determining the amount of fertilizer while the grain is in the fields is a challenge. Fritzmeier Umwelttechnik GmbH & Co. KG has developed a light-based solution for this. The chlorophyll of plants plays an important role in this process. It is generally known that chlorophyll is responsible for photosynthesis and is thus crucial in the metabolic cycle of plants. At the same time, the amount of chlorophyll in the leaves is a good indication of the nitrogen requirement because the plant uses this to develop the pigment, as well as other things. Nitrogen deficiency is therefore indicated by the fact that too little chlorophyll is available. Especially older leaves appear light green or yellow and often have brownish tips. The plant hardly grows any more. It appears smaller and paltrier than the others. If there is an oversupply of nitrogen, however, it grows too fast.

It produces too many amino acids and proteins and no longer has the strength to form the necessary strengthening tissue. The result is soft, unstable, blue-green colored leaves. The plants are weakened and vulnerable to parasites and diseases. These differences in leaf color are not always visible to the naked eye. However, a sensitive sensor can detect the differences in radiance from which the nitrogen supply of the plants can be deduced.

Invisible Indicator

The green color results from the absorption behavior of chlorophyll. During photosynthesis, the energy of sunlight is used to convert water and carbon dioxide into glucose, which is needed for metabolism. The plant mainly uses the short-wave blue and the long-wave red part of light for this.

The need is determined directly when fertilizing.

The green wavelengths, on the other hand, are reflected, and the leaves appear green. Since chlorophyll production increases with the nitrogen supply, the amount of blue and red light absorbed also increases. At the same time, however, more radiation is reflected in the near infrared range because as more biomass is produced, the more multiple reflections increase on the tissue structures of the plant. The nitrogen requirement of the plant can be calculated from the ratio between this infrared reflection and the reflection in the visible red spectrum.

The green of the leaves reveals how the plant is doing.

More Yield – Less Environmental Damage

Fritzmeier uses this measuring method for its ISARIA PRO Active and ISARIA PRO Compact systems. The sensors are mounted directly on the tractor with which the farmer spreads the fertilizer. With the aid of software, the fertilizer can be controlled based on the amount needed, and each plant receives as much nitrogen as it requires at any given moment. The more economical ISARIA PRO Compact system is designed for use in daylight, while ISARIA PRO Active has its own LED light sources and can be used regardless of the existing lighting conditions. The manufacturer was able to prove in tests that the economic efficiency, for example in grain cultivation, can be increased by more than 10%. The bottom line is that farmers and the environment benefit equally from smart farming. ■

Si Avalanche Photodiodes

With a sensitive range from 260 nm to 1100 nm, silicon photodiodes cover the entire visible spectrum into the near infrared range. They are therefore particularly suitable for use in the visible spectrum. They are inexpensive, easy to manufacture, and are considered to be particularly low noise. For applications where even small amounts of light have to be detected, we recommend Si avalanche photodiodes. With appropriate band-pass filters, specific wavelengths can be used selectively.

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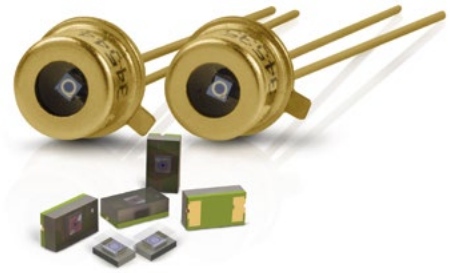
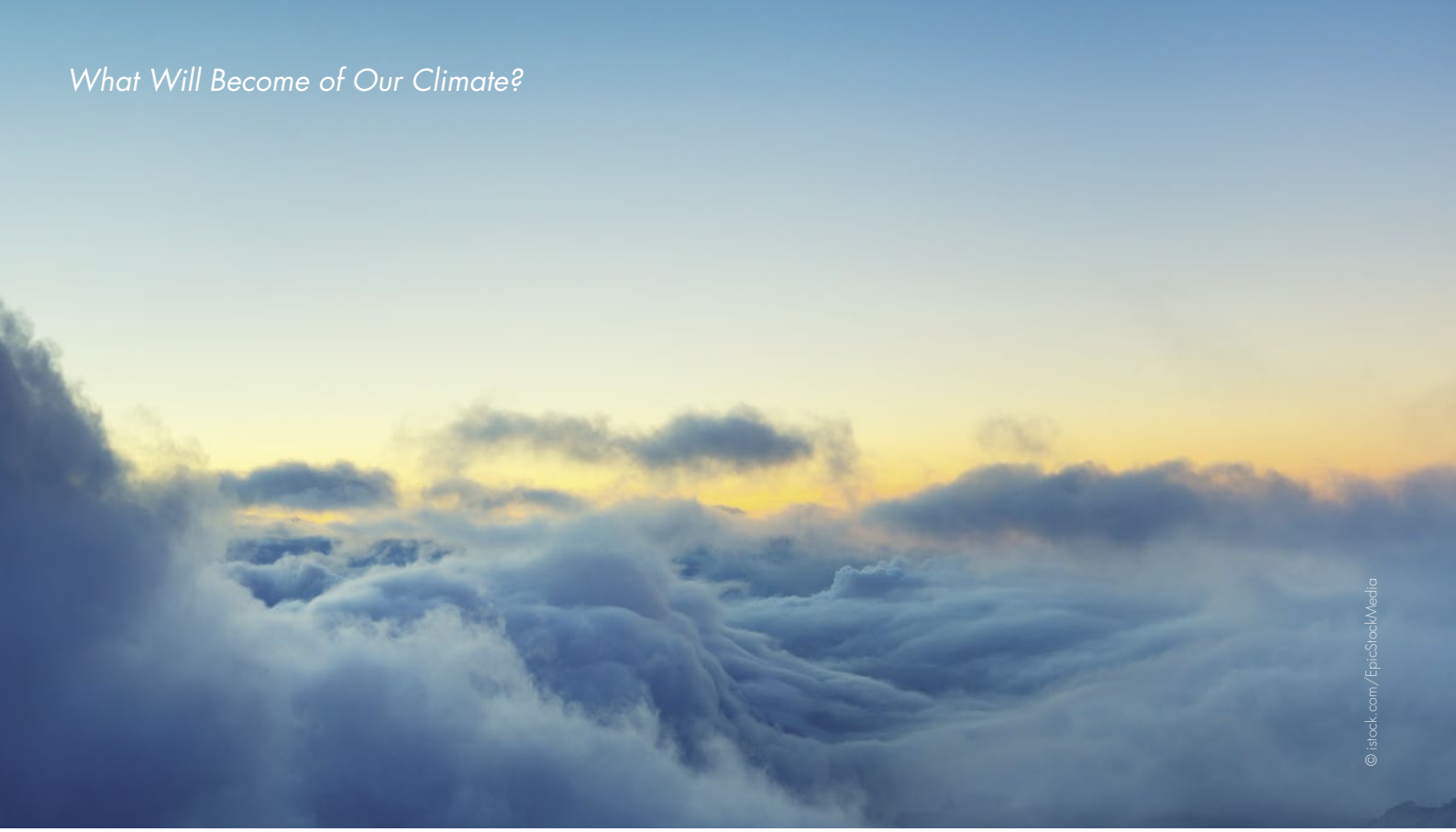




Good Atmosphere

Sophisticated LiDAR Telescopes Measure Water Vapor

The natural greenhouse effect has always determined our climate and played a significant role in making our planet habitable. The average temperature on the Earth's surface is currently a rather pleasant 14 °C, which creates optimal conditions for various vegetable and animal life to prevail. This effect is caused to a large extent (approx. 60%) by the water vapor contained in the atmosphere. Together with other gases like carbon dioxide (CO_2) and methane (CH_4), it reflects the heat radiation of the planet and prevents it from "disappearing" into space. Without this effect, the average temperature on Earth would be around -18 °C. However, water vapor plays another crucial role in the greenhouse effect, i.e., the so-called water vapor feedback effect. This refers to the effect by which the warmer the Earth's atmosphere becomes, the more water vapor it can absorb. This increases heat reflection, and the atmosphere heats up even more. Scientists assume that a similar "galloping greenhouse effect" occurred on Venus millions of years ago and was responsible for the average temperatures of around 440 °C that prevail today due to the particularly dense atmosphere of our neighboring planet.

Water vapor backscattering must be avoided.

Specific Wavelengths

Therefore, it is more than understandable that scientists are interested in learning more about the water vapor in our atmosphere. For this purpose, they rely on optical methods such as differential absorption LiDAR (DIAL) and Raman LiDAR. Unlike the distance meters that are "commercially available" and that we have presented in previous issues (e.g., Photonics News 80, 84, and 85), these two technologies are capable, among other things, of determining the concentration of certain substances. For this purpose, DIAL simultaneously sends two laser beams with closely adjacent wavelengths into the atmosphere. The first wavelength – the so-called "online wavelength" – is selected so that it can be absorbed as strongly as possible by the molecule to be measured. Its counterpart, the "offline wavelength", is absorbed as little as possible, and ideally not at all. It serves as a reference value for the measurement. From the difference of the reflected light components, information about the gas density of the molecule being searched for can be calculated. Since the wavelengths are exactly matched to the absorption behavior of a specific molecule, this method can only be used to measure one specific gas (e.g., water vapor). In addition, general conditions such as the daytime temperature must be considered in the calculation.

Each gas has its own Raman signature.

Shifted Reflections

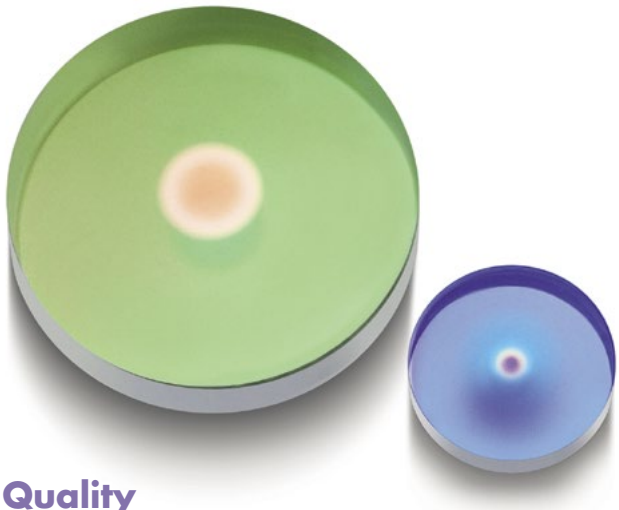
The second method is used to measure inelastic Raman scattering. A part of the light interacts with the molecules it encounters. Characteristic oscillations occur in the molecule that scatter the light back at a different wavelength. This so-called Raman backscattering is specific for each molecule and thus allows conclusions to be drawn about the molecular composition of a layer of air. Unlike DIAL, the Raman effect does not depend on the wavelength of the emitted beam. Therefore, essentially any monochromatic light source with enough power to penetrate the higher levels of the atmosphere can be used for this method. Furthermore, it must be considered that the Raman signal is significantly less intense than classic Rayleigh scattering. For these two reasons, short-wavelength lasers are preferred in research. They have both high energy and the effect that the Raman signal is more clearly visible at short wavelengths.

Peak Performance

Since both methods have their advantages and disadvantages, the best results can be achieved with a combination of both. In Germany, several projects are currently underway for the long-term observation and monitoring of water vapor in the atmosphere. One of the most important measuring stations is located at the Schneefernerhaus directly below the Zugspitze summit at an altitude of 2656 meters. At this altitude, measurements are less frequently affected by clouds or fog. These moist layers of air would scatter the laser beam too much. Also, impairment due to environmental pollution and other particles – so-called aerosols – is considerably less in the comparatively clear mountain air. The Karlsruhe Institute of Technology (KIT) operates a powerful DIAL telescope on the highest mountain in Germany, which can carry out measurements up to a height of 12 km. For this purpose, scientists use a tunable Ti:sapphire laser, which is pumped by a frequency-doubled Nd:YAG laser (532 nm). For several years now, the facility has had a specially developed Raman LiDAR available, which is operated with a high-energy excimer laser (308 nm). This system can even deliver values from heights of more than 20 km. ■

Uniform Course

The wavelengths for DIAL and Raman LiDAR are often generated by frequency doubling. For example, the frequency of an Nd:YAG laser that has a wavelength of 1064 nm is doubled by interaction with nonlinear laser materials. This corresponds to a reduction in the wavelength by half to 532 nm. The higher the intensity of the original beam, the better this transformation works. Therefore, Gaussian mirrors are often used to achieve high beam intensity and increase pump efficiency. These mirrors are also referred to as graded reflectivity mirrors (GRMs) because the degree of reflection decreases along a Gaussian curve from the center of the optics to the edge. Accordingly, the beam has a high intensity once it has passed through the optics. GRMs are always used for the monochromatic light of a certain wavelength. LASER COMPONENTS manufactures standard Gaussian mirrors for the wavelength of 1064 nm. Other wavelengths are available upon request.



Tested Quality

The production of Gaussian mirrors is very costly. The biggest challenge is the smooth transition in reflectivity. This is also the decisive quality feature of a GRM. Meticulous quality control is therefore much more important for these optics than for conventional mirrors and lenses. Therefore, this feature is examined in addition to the usual outgoing goods inspection.

The R&D department at LASER COMPONENTS has set up an automated measuring station to examine each Gaussian optic before it leaves the production facility. A continuous-wave laser scans the mirror along its diameter and thus documents the reflection values across its entire width. Only mirrors that meet the customer's specifications in all criteria are delivered.

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WEB N12-006

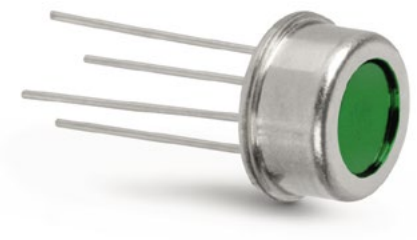
NEW PRODUCTS

High Detectivity at Low Modulation Frequencies

Temperature-stable Pyroelectric Detectors

WEB N12-033

Fourier-Transformed Infra-Red spectroscopy (FTIR) requires particularly sensitive detectors. At low to medium modulation frequencies, special pyroelectric LTO detectors are very well suited for this purpose. LASER COMPONENTS' LT3111 series pyroelectric detectors offer high detectivity and a good signal-to-noise ratio at low modulation frequencies. At 10 Hz the specific detectivity is typically 4.0E+09 Jones. As a result, the LT3111 detectors perform similarly to the more expensive thermoelectrically cooled semiconductor detectors.



For pyroelectric detectors, the basic rule is that thinner chips provide higher detectivity. In this case, we use chips with a thickness of 7 µm. LTO chips are extremely robust and above all temperature stable. While other detector types in industrial environments require a Peltier element, LTO technology works well even at high temperatures without additional cooling. ■

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IR Laser Diode ADL-85Y51TL

Small Package, Great Performance

WEB N12-049

With an output of 250 mW from a 5.6 mm housing, Arima's ADL-85Y51TL offers the highest laser power in a small package at a reasonable price. The single-mode laser diode emits a continuous beam (cw) at an IR wavelength of 850 nm. It is especially designed for applications in which the power distribution remains comparatively consistent even across longer distances. This is ensured by the divergence angle of 8° x 17°, which is small for a laser diode.

The ADL-85Y51TL is interesting for use in many industries (e.g., for laser distance measurement, sensor technology, and face recognition). It also opens up new fields of application in aesthetic medicine and photodynamic therapy. ■

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FLEXPOINT® Modules with Pulsed Continuous Wave Lasers

Laser Protection Class 2 at High Energy Output

WEB N12-074

In industrial image processing "more light" means faster shutter times and shorter process times. More images can be captured and evaluated per second. At the same time, however, most systems must also meet laser class 2 requirements to protect employees' health. FLEXPOINT® MVpulse line laser modules have combined both requirements for the first time. The continuous wave laser beam is pulsed by an integrated microcontroller in such a way that each pulse is up to five times stronger than would be possible in cw operation. Measured along a defined pulse sequence, the module still meets the requirements of laser class 1 or 2 respectively.

An electronic system developed by LASER COMPONENTS monitors the control signals of the application, allowing the light to always be available when it is needed for the application. At the same time, the energy and duration of the individual pulses can be adjusted in such a way that the laser protection requirements can always be met.

The FLEXPOINT® MVpulse is available for the wavelengths 640 nm, 660 nm, and 780 nm and delivers output powers of 10 mW to 100 mW at pulse lengths between 15 ms and 0.38 ms. ■

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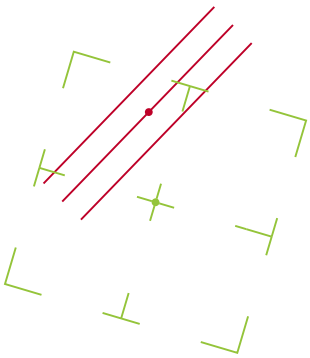
More than Twenty New Beam Patterns

New Solutions for More Accurate Imaging



WEB N12-274

For our FLEXPOINT® modules you can now choose from an even larger variety of beam patterns. To better capture even complex shapes, we have expanded our product range to include more than twenty DOE pattern generators. This includes multiple lines with three or eighty-one lines. Among cross-hair lasers, the largest fan angle is now 75°; this allows a very large X to be generated even at short distances. The selection of "truly random patterns" for 3D stereo image processing alone has been expanded by four new versions. Several new options are also available for both infrared wavelengths and green and blue laser modules. All patterns can be integrated into our standard FLEXPOINT® modules. ■

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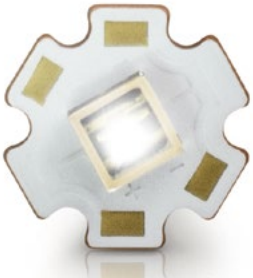
Global Novelty: Switchable Light Source

Visible and Invisible Wavelength from the Same Chip



WEB N12-045

LaserLight SMD W-IR is the world's first white light source that can be transformed into an IR emitter on demand. As usual from the manufacturer SLD Laser, the white light source offers a high range, narrow beam angle, and outstanding properties in luminous flux (450 lumens) and luminance (1000 Mcd/m²). In IR operation, an output of 250 mW is achieved at a wavelength of 905 nm or 850 nm. Both emitters are housed on the same 7 mm x 7 mm chip. To facilitate PCB assembly, the chips are also optionally available on starboard.

IR wavelengths are mainly used in professional security applications. With the new chip, it would be conceivable in the future, for example, for the surveillance camera to automatically switch on the light as soon as suspicious movements were detected. The motion sensor and lighting could be accommodated in the same device in a space-saving manner and without complex cabling. ■

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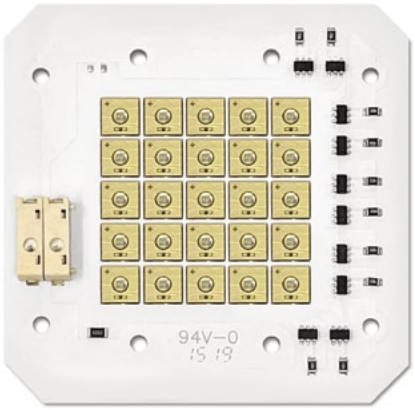
Bolb's Germicidal UVC Arrays

100 mW of Power per Chip

WEB N12-042

Bolb offers its UV LEDs not only as single emitters but as fully assembled arrays as well. The easy-to-install boards provide an optical power of 100 mW or more per chip. Currently, both the S6060 and S3535 types of LEDs are available in arrays with 1x4, 1x12, and 5x5 diodes. UVC LEDs (typically 270 nm) are used in many different applications (e.g., for sterilizing and disinfecting air, water, and surfaces in industry and healthcare).



The device developers in these industries are specialists in their field but often have little experience with LED technology. They are mainly interested in a compact design and quick application in their own devices. Arrays offer exactly this advantage. In addition, their high performance allows significantly shorter treatment times, which would not be possible with individual LEDs. ■

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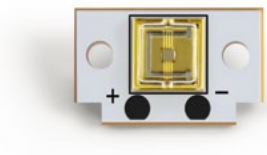
Powerful VCSELs for LiDAR Applications

IR Emitters with Short Rise Times

WEB N12-075

Leading market research institutes forecast rapid growth for the global VCSEL market until 2030. LASER COMPONENTS covers power ranges between 200 mW and 50 W with a wide range of IR wavelengths between 850 nm and 940 nm. Upon customer request, laser diodes are also available as high-power arrays. Such compact, high-power, multi-mode lasers are primarily required in the LiDAR range, where high power lasers are crucial for the range of a system.

Vertical-cavity surface-emitting lasers (VCSELs) are so-called surface emitters in which the light is emitted perpendicular to the chip's surface to allow the beam to be easily collimated. The extremely short rise times enable fast pulse sequences in the low nanosecond range and below. Due to the semiconductor structure, the emission wavelength hardly changes with temperature fluctuations. Thus, a narrow-band bandpass filter can be integrated on the detector side. ■



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Complete New Control Platform Is More Powerful and Easier to Use

Drastically Reduce Set-up Times for Complex Precision Motion Control

WEB N12-072

Aerotech's Automation1 precision machine and motion control platform includes a wide selection of products for controlling industrial and research laser processes – especially those with challenging motion control requirements. The Studio application simplifies system setup and tuning and includes a modern IDE for programming your machine.

The Automation1 controller features higher data rates and improved security. The platform also highlights improved servo motor, laser scan heads, and piezo actuator drive electronics. ■

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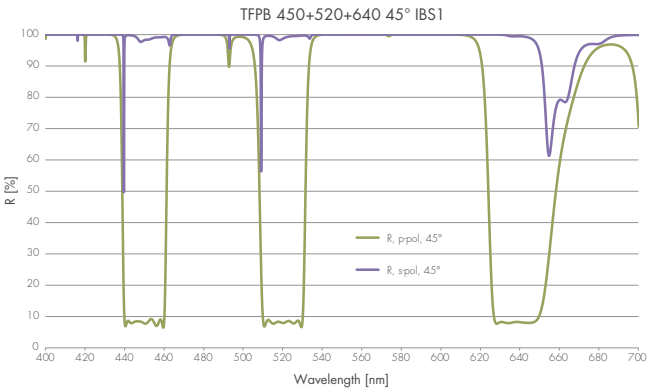
Polarize Three Wavelengths Simultaneously

Trichroid Thin-Film Polarizers

WEB N12-001

LASER COMPONENTS has for the first time developed a thin-film polarizer that makes it possible to simultaneously separate the polarizations of three wavelengths. Designed for an angle of incidence of 45°, the optics show excellent reflection properties for s-polarization in blue (450 nm), green (520 nm), and red (640 nm) light, while p-polarization is almost completely transmitted.

In optical systems, such polarizers can be used, among other things, to combine linearly polarized laser beams from several sources – regardless of whether they have the same or different wavelengths. Conversely, these types of optics make it possible to separate unpolarized light at three wavelengths into the two polarizations simultaneously.



While the manufacture of thin-film polarizers is no longer an art, trichroid polarizers present a major challenge. The complex layer design is produced in our ion beam sputtering (IBS) facility, which enables particularly compact layer structures with good reflection properties. ■

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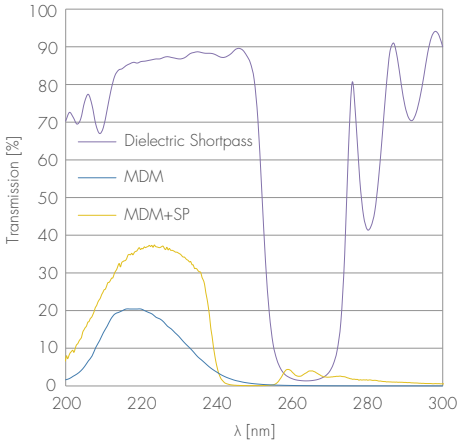
New UV Bandpass Filters Target Sterilization Applications

Shortpass, Bandpass, and Combination Filters

WEB N12-002

Omega Optical has developed UV Bandpass filters in the 200–260 nm range that are ideal for applications such as sterilization of surfaces, water or air. Omega offers a Dielectric Short Pass (SP) with a cut-off at 250 nm, a Metal-Dielectric-Metal (MDM) with a center wavelength of 220 nm with 20% transmission, and a combination filter of the MDM and Dielectric Short Pass.



Omega's onsite optics shop allows us to offer custom sizing and configuring to fit your needs. Omega's innovation and machine capacity allows us to do custom runs cost-effectively at a high volume. ■

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Measuring Device for Lasers in the Visible and IR Range

Short Response Time for Power Measurements up to 9W

WEB N12-071

In the IS12L-9S-RSI power meter, Gentec-EO uses the principle of the integrating sphere to close the gap between classic photodetectors and thermoelectric detectors. The inner coating of the sphere was developed by the manufacturer. With a maximum power density of 2 kW/cm² at 1064 nm, the damage threshold is considerably higher than that of other manufacturers. The result is a very wide measuring range from the µW range up to a cw output power of 9 W. This amount of high power clearly exceeds the capabilities of a commercially available photodiode. In addition to determining the performance of strongly divergent beams, this detector offers further advantages. Unlike photodetectors, the angle of incidence of the beam can deviate up to 10° from the ideal position without affecting the measurement result.

This instrument is traceably calibrated to NIST standards for the entire range between 405 nm and 1064 nm. With free software it can be operated directly on a PC via an integrated USB interface. A version with an RS-232 interface is also available on an optional basis. ■

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WEB N12-074

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* Maximum laser class 2 according to DIN EN 60825-1:2015-07

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