PHOTONICS NEWS

Company Newspaper of the LASER COMPONENTS (UK), Ltd.

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#61 ▪ 10|18

LOST & FOUND

Following Warmer Climes

Building Cruise Liners

Laser Welding for Functional Clothing

Maya City Explored with LiDAR

Emotions Measured in Cinemas

New Products

LASER COMPONENTS

small components
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- Laser Curtain Systems
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- Portable
- Blackout
- Roller Shades
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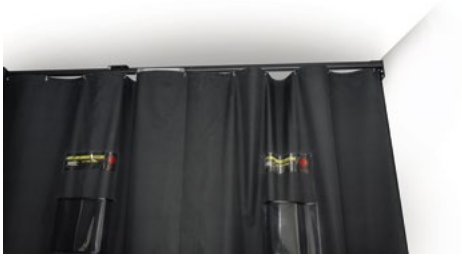
- Optical Table Barriers

Laser Safety Windows



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- Trap-It Beam Dumps

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Imprint

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Dear Colleagues

It is pretty fascinating how light can be used in such diverse ways, whether seeing through trees, producing seamless garments, 3D Tetris shipbuilding or determining moviegoers' moods. This issue of Photonics News highlights such varied applications.

Increasingly sensitive optical detection systems mean that fewer and fewer photons are now required in sensors thus making instruments smaller, cheaper, and require less electrical power. Already many sensors are wearable. We can all relate to a photographic camera that once was something the size of a small cabbage, and is now smaller than a sugar cube within a smart phone that also does countless other things, unlike the SLR camera that just takes photos. Couple such optical systems with timing of light pulses reflected off a forest floor, then we have the making of drone borne cameras capable of seeing through tree canopies to map the terrain. Seems like magic.

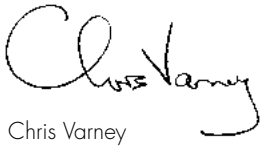
Since light can be focussed and manipulated across a surface with lightning speed, engineers in Switzerland have developed seamless joins in clothing whilst maintaining the mechanical integrity of a single sheet fabric without a join. Instead of needle and thread, lasers now produce garments that have no joins, increasing strength and removing weak seams that might tear.

Laser beams have a convenient property of travelling in straight lines with much less divergence than an incandescent lightbulb with collimating optics. The laser beam can also be produced with a small diameter spot of light. These two properties allow us to see the beam for greater distances. Placing a position sensitive detector on the optical axis gives us a means of measuring straightness to many orders of magnitude greater than the Romans achieved two thousand years ago when building straight roads in the UK and mainland Europe. With micron precision, shipbuilding has taken on a new level of construction akin to precision three dimensional Tetris. Read the article!

It is also fascinating to see a form of translation into photonics that might have been the predominant domain of another technology. Humans and especially dogs are pretty good at distinguishing between smells that rely on our olfactory sensors, i.e. chemoreception that forms the sense of smell. We can do a pretty good job using photonics instead of chemicals, but with considerably faster acquisition. In this case spectroscopy allows us to measure the absorption of certain airborne chemicals in a space occupied by humans, such as in a cinema, and coupled with sophisticated algorithms various odours give an amazing insight in to deducing the feelings of moviegoers.

Please look at our selection of products in the latter pages, each with more detail found on our website. And please do pop by our booth at Photonex Europe in Coventry at the Ricoh Arena, it will be a pleasure to meet you.

Yours,



Chris Varney

Norwegian Bliss

The Norwegian Bliss undocked on February 19, 2018. Transfer to the North Sea began on March 13, 2018. At only 0.2 knots, the 333.4-metre-long and 41.4-metre-wide ship was discharged from the MEYER WERFT shipyard and steered backwards towards the sea on the Ems River for better manoeuvrability. In June, the "Breakway Plus" class ship will set sail from Seattle for a seven-day cruise to Alaska. From November they will be found in the eastern Caribbean.

This ship is one of the most state-of-the-art cruise ships. 27 dining options, a theatre with over 800 seats, the longest (electric) go-kart track at sea, a 180-degree panorama observation lounge, multi-story water slides – one of which goes beyond the railing – and many more attractions promise guests an unforgettable journey. More than 1,700 crew members ensure the well-being of the approximately 4,000 passengers. ■

STRAIGHT & FAR

State-of-the-Art Sensor Technology in Shipbuilding

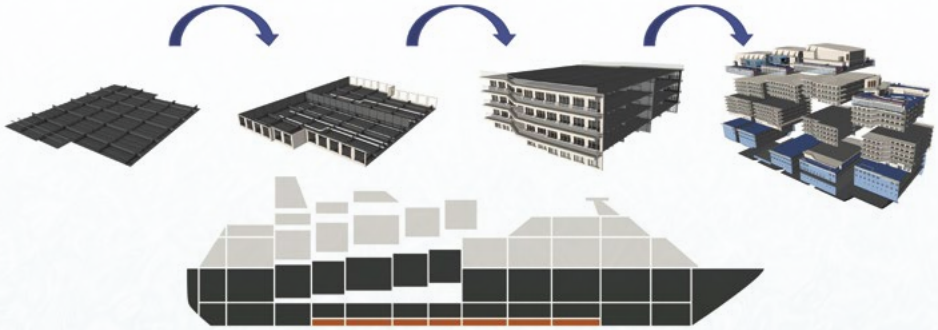
"A cruise is fun. A cruise is beautiful." More and more tourists are convinced of this. According to a current estimate, 27 million cruises[1] will be booked worldwide this year, which is about one and a half times as many as ten years ago[2]. It is no wonder, then, that more and more, larger and larger ships are sailing the seas. The order books at the shipyards are full. Keeping the construction time of ocean giants like the "Norwegian Bliss" (see photo) as short as possible requires not only perfect project management but also the means to carry out precision work with steel structures that weigh tons.

Continue on page 006 ➔

1 http://www.cliadeutschland.de/pdf/2017/35-15.12.2017_CLIA-Outlook-of-the-Industry_Praesentation.pdf
2 https://de.statista.com/statistik/daten/studie/168360/umfrage/passagiere-auf-kreuzfahrten-weltweit/

Ship Puzzle

When renowned shipping companies need new cruise ships, they turn to MEYER WERFT in Papenburg. In its 223-year company history, this family-run business from Lower Saxony has repeatedly proven that pioneering spirit and belief in new technologies pay off.



© Jens Schröder

A cruise ship is constructed with different modules in a block-building process.

When Josef L. Meyer decided in the 1870s to focus resolutely on the construction of steam-powered steel ships, many Papenburg shipping company and shipyard owners looked upon him with mild amusement. History has proven him right: In the 19th century, there were about twenty shipbuilding companies in the city, and of them only MEYER WERFT has survived to this day.

The decision to start building luxury cruise ships has also proven to be the right one. In 1984, when the company accepted the order for the ocean giant "Homeric", this outcome could not have been foreseen. The project was a risk and associated with many technical challenges. For example, a new lock had to be built specifically for the purpose of removing the ship from the dock when it was finished.

From Small to Large

MEYER WERFT is still one of the most modern shipbuilding facilities in the world. Following the principle of modular construction, the production of luxury liners such as the "Norwegian Bliss" takes just nine months from when the keel is laid to launch. By comparison, this new ship is about four times the size of the "Homeric", which was completed in 1985 and spent a year in the building dock at the time.

In modular construction, small partial elements are prefabricated and then assembled into ever larger units: Initially, individual steel plates are painted with a sealant to protect against corrosion, cut to size with a plasma burner, and welded together to form panels. Other components that are important at a later stage for the operation of the ship are also manufactured in advance.

This means that production of these individual parts can begin immediately after the order has been accepted while the building docks are still occupied by other ships.

The heart of steel construction is the automated panel line. There, the cut steel plates with profiles, beams, and side walls are processed into so-called sections. The thermal insulation, as well as the cable wiring and piping packages, in which up to 250km of electricity and water pipes will run later, are also laid now. The production facility works, so to speak, in a figurative headstand. The steel plates, to which all other elements are attached, serve as cabin ceilings in the completed ship, the cable ducts and pipes are used to supply the cabin above. Every four hours a finished section leaves the production hall.

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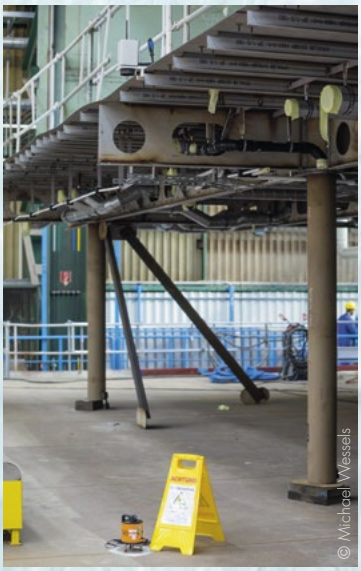

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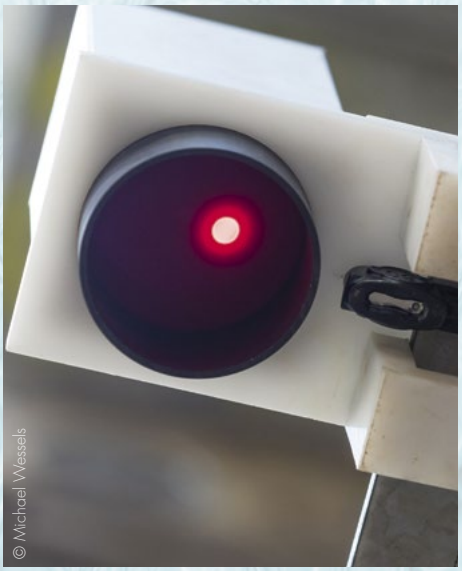

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In the construction dock (left), self-levelling lasers (centre) and precision detectors (right) ensure millimetre-precise positioning of the sections weighing several tons.

Ralph Zimmermann, Head of Surveying at MEYER WERFT in Papenburg:
"Producing a modular cruise ship for 4,000 passengers means assembling many individual pieces with millimetre precision. Traditional methods are complex, cost time, and require a lot of personnel. With state-of-the-art laser technology, we can work much more precisely and efficiently nowadays."

A Precision Job for Strong Men – From Section to Block

This time it remains for shipyard workers to assemble the finished sections into the next larger units. About eight to ten of them form a block that extends across the entire width of the ship. The blocks are up to 37 metres long and up to six decks high. In order to form a perfect unit, the individual sections must be positioned exactly. This is done manually. Since a crane is too inaccurate due to the inertia in the crosshead and rope, the shipyard workers use hydraulic traction and compression presses to fit the parts, which weigh around 160 tons, with millimetre precision.

Achieving this precision is one of the greatest challenges. Mechanical plummets were used for a long time; however, they were very susceptible to wind. They were constantly "off centre" and also had to be read visually. In order to align the sections precisely, their position had to be measured in a separate work step by measuring teams using tachymeters. Then it was readjusted and measured again until the component had arrived at the right spot. "This laborious process consumed a lot of resources," says Ralph Zimmermann, Head of Surveying at MEYER WERFT. "That's why we've been looking for a state-of-the-art method for a long time. Shipbuilders should control their work as self-sufficiently as possible. At the same time, the technology had to withstand the everyday working conditions in a shipyard."

Positioning Lasers in Action

Prefabricated "off-the-shelf" solutions did not meet these requirements. After extensive tests, an optoelectronic alignment system has been in use since the autumn of 2017, which the shipyard has developed together with LASER COMPONENTS and the Neubrandenburg University of Applied Sciences. In laser-assisted alignment, four lasers each are placed on the front and rear of the hall floor and anchored with integrated bolts. These self-levelling lasers automatically level out unevenness so that the laser beam is always perpendicular. A detector is attached to the section ceiling above each laser, which evaluates the position of the beam similar to the crosshairs of a rifle scope. The data is then transmitted by radio to a display so that the shipbuilders are always informed about the exact position. When all eight beams hit their target exactly in the centre, the section is in the right place and assembly can begin.

In this way, the blocks are not only completed more accurately but also faster. Ralph Zimmermann is enthusiastic about the alignment system: "The positive effects on our production processes can already be clearly seen. I can no longer imagine the daily work performed at MEYER WERFT without this system." Accordingly, the next step is already being planned. Then it is a matter of positioning the entire blocks. Up to now, costly, sensitive tachymeters have been used to assemble around 70 of these "puzzle pieces," which weigh up to 800 tons, into a ship. Here, too, lasers could soon point the way. ■

Such Theatrics!

Did you know that MEYER WERFT is the largest German theatre builder? Today, every modern cruise ship has at least one large theatre hall with up to 1,000 seats, a fly tower for changing sets, and a retractable orchestra pit. This is why MEYER WERFT has built more theatres than any other company in Germany.

Precise Adjustment across Long Distances

With the STRAIGHTliner FAR laser alignment system, components can be positioned across distances of up to 200m with millimetre precision. This is important not only in shipbuilding but also in the alignment of machines, rails, cranes and elevators.

The system features a long-range laser module that can be focused to a point that has a diameter of less than 15mm at a distance of 200m. The equipment also includes the wireless connection of an extra-large detector to a PC and intuitive Windows software with graphical user guidance. ■

WEB UK61-0770

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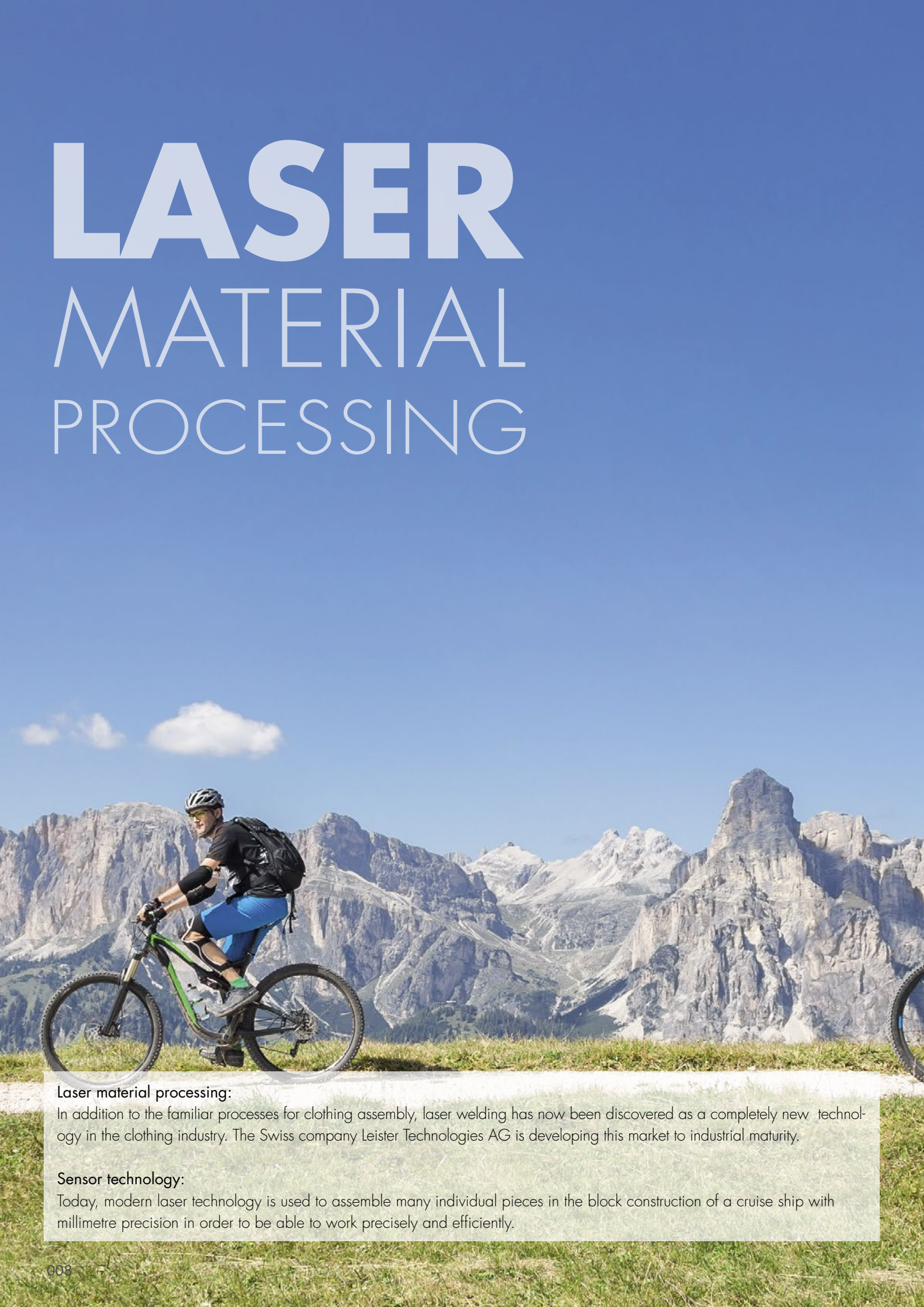
LASER MATERIAL PROCESSING



Laser material processing:
In addition to the familiar processes for clothing assembly, laser welding has now been discovered as a completely new technology in the clothing industry. The Swiss company Leister Technologies AG is developing this market to industrial maturity.

Sensor technology:
Today, modern laser technology is used to assemble many individual pieces in the block construction of a cruise ship with millimetre precision in order to be able to work precisely and efficiently.

Innovative Processing of Apparel

Flat and Low-friction Seams via Laser Welding

Machine sewing, hot-air welding, and ultrasound are well-known procedures applied in the finishing of clothing. Laser welding is a completely new technology used in the clothing industry. The Swiss company Leister Technologies AG is developing this market to industrial maturity. Promising garment prototypes are already being produced. We spoke to project manager Frederike Lehmeier about this new process. "Compared to ultrasonic welding, laser-welded seams have an undamaged fabric surface; melting points are not visible on the surface. Adhesive material is not required either," she explained the advantages.

Continue on page 010 ➔

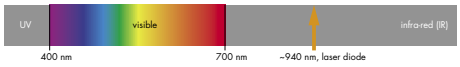
Laser welding is therefore particularly interesting for functional clothing: the seams can be extremely flat, elastic, and therefore skin-friendly. A so-called seamless effect can be achieved because the outside of the materials to be welded is not damaged. This technology is based on laser transmission welding, in which fibre-guided diode lasers are used in the near IR (NIR) range.

Laser transmission welding requires working with a laser-transparent and a laser-absorbing material. These two materials are joined exclusively between both material layers. Another possibility is the use of exclusively transparent materials; in this process, absorbers are partially applied to the positions to be welded.

The basic rules of laser welding:

1. Transparency and absorption are required

A laser transmission weld requires a transparent and an absorbent textile when lasers with a wavelength of 940nm are used.



2. Welding same with same

In laser welding, thermoplastic materials are joined together. During the welding process, laser radiation is absorbed by plastic and converted into heat. Thermoplastics are plasticised in the joining zone and joined under pressure.

In order to achieve a connection with high strength, similarly-typed thermoplastics should primarily be used. Practically speaking, this means, for example, that polyester can only be welded with polyester and polypropylene only with polypropylene. Working with the same materials has a positive ecological impact on a subsequent recycling process and is becoming important for increasingly sustainable production in the textile and clothing industry.

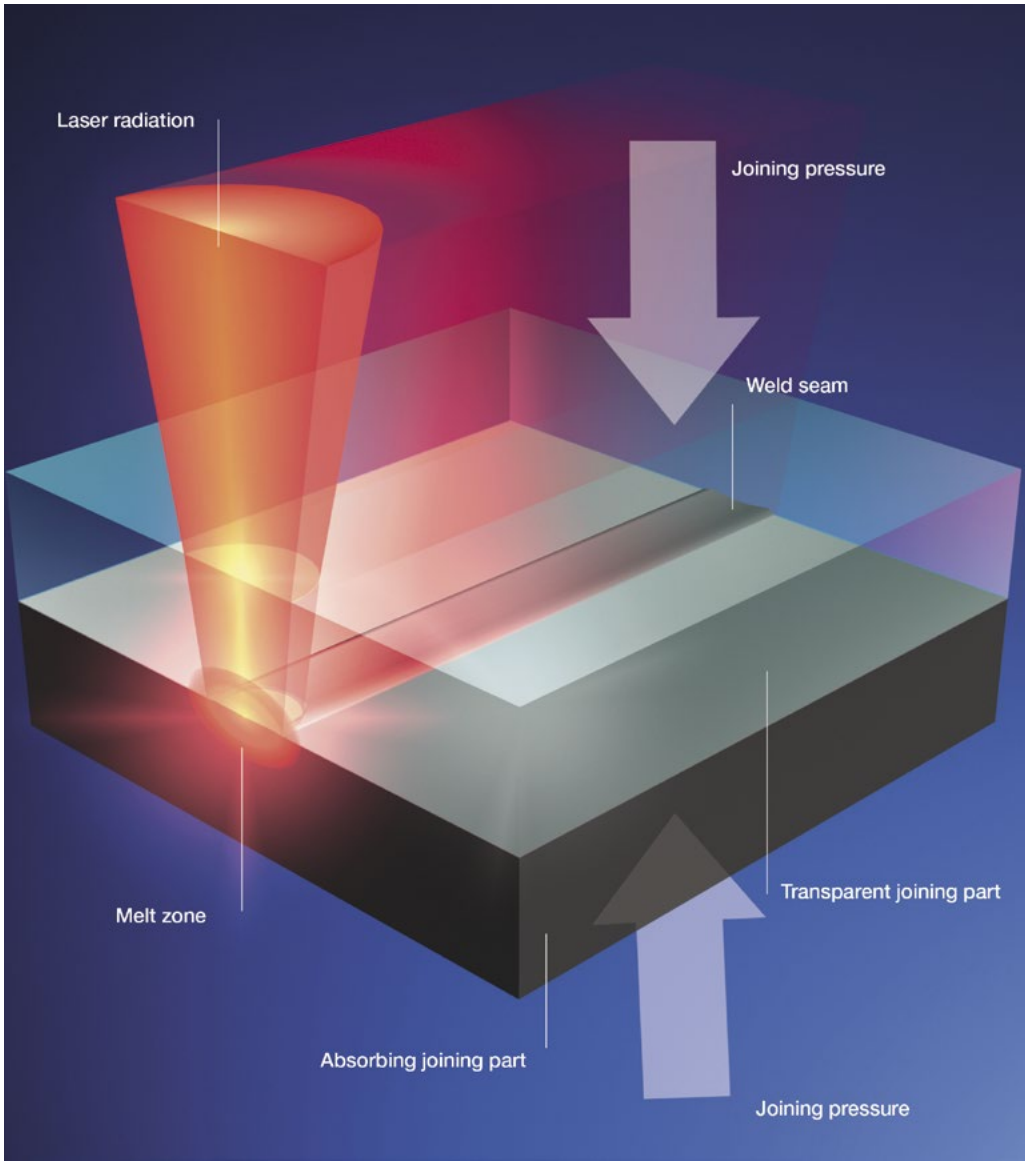
Materialisation

Materials tested to date in the textile and clothing industry include single-layer elastic and non-elastic knitted and woven fabrics, spacer fabrics, non-woven materials, membranes between 10µm and 25µm, and multi-layer textiles (laminates). The chemical basis is largely polyester articles and, for knitted fabrics, polyamides and polypropylene articles.

In addition to polyester products, polyurethane-based materials can also be welded. The low foreign fibre content of a material type (e.g. elastane) does not significantly influence the laser welding process and the seam quality as long as they have laser-transparent properties.

Many of the textile materials available on a standard basis have laser-transparent properties. It is more difficult to use materials with sufficiently high absorption; they usually have a dark shade. Working with absorbent and transparent materials is often accompanied by a two-tone appearance.

If this is not desired, purely transparent materials can also be processed together "using a trick:" Either mostly liquid, NIR-absorbing pigments (absorbers) are introduced or additional absorbent materials are used.



Leister Technologies AG is developing two machine concepts for processing textiles.

A two-dimensional cutting and welding system for the clothing industry will be available as early as 2019. This laser system is based on a vacuum table and can draw in up to three layers of material. Welding and cutting is carried out completely automatically, and different tool heads are applied for each process step. Globo Optic is used for laser welding. The cutting process is performed using a knife tool, which can be selected depending on the material being processed. An inkjet printing head can be integrated on an optional basis to print absorbers on transparent textiles.

In 2020, a continuously manually-operated laser sewing machine will be available as a standard product for shaping seams. In this development, laser technology is integrated into the mechanical engineering process that is well known in textile and clothing technology. This operation is carried out for the user with the help of a similarly familiar methodology. Machine designs and dimensions, as well as the classification as laser class 1, allow positioning in a conventional production line. ■

Application Fields and Seam Shapes

Low-friction, flat, and flexible laser welds are ideal for garments that come into contact with the skin. This increases the wearing comfort of underwear, swimwear, sportswear, and fitness clothing – an enormous benefit for sweaty athletes who wish to enjoy the highest wearing comfort! This has been successfully tested in practice.

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Two main seam shapes are used for textiles.

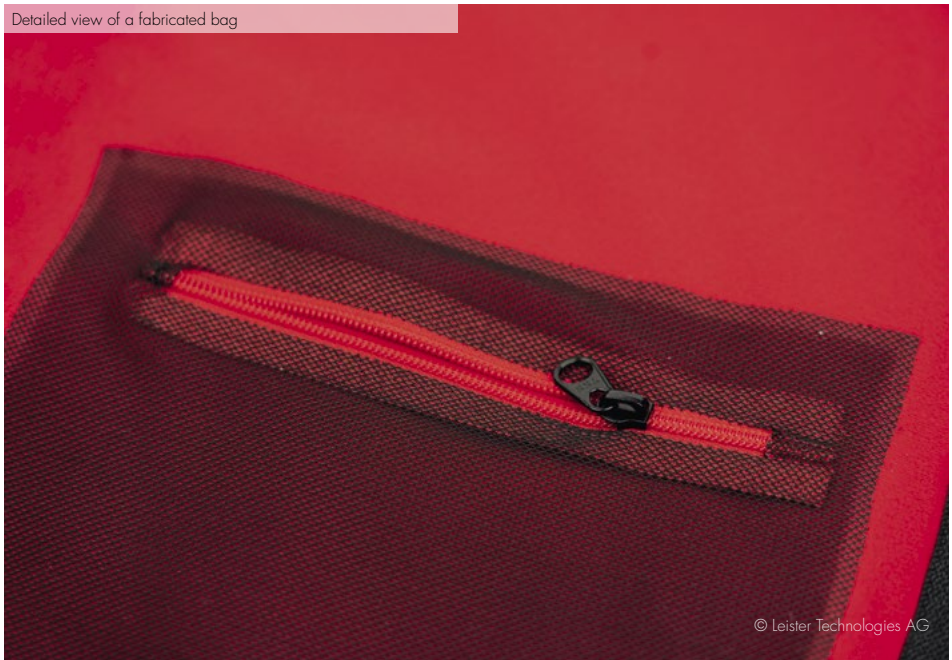
1. Seam shapes for two-dimensional connections are used, for example, for attaching pockets but also for decorations, reinforcements, or fixing insulating materials to outer fabrics. This technology can be particularly interesting for the continuously growing wearables market if sensors and other technical components are incorporated directly into the clothing.
2. Three-dimensional, shaping seams are used, for example, for overlapping seams, hemming seams or the welding of strip materials.

Outlook

Laser welding yields a new joining technology for clothing, textile products in medical technology, and technical textiles. Manufacturers and brands in the textile and clothing industry have a high need for innovation and differentiation in a highly competitive market. This development takes into account innovative laser technology.

Leister pioneered the development of textile-specific laser machines. We are working on making the sophisticated processing of textiles industrially accessible by means of suitable machines. ■

The project leader F. Lehmeier during the prototype test



Detailed view of a fabricated bag

Secrets in the Rainforest

New Insights into Ancient Cultures

Impenetrable Rainforest

Everyone has seen pictures of the temples and pyramids of Tikal. But if you have not visited it yet, it is hard to imagine how vast the ruins really are. The national park in which they are located covers an area of 575 km^2. Most of it is covered in dense rainforest. Compared to the surrounding Mayan biosphere reserve, however, this is only a small blob. This huge nature reserve in the northern part of the province of Petén covers 21,000 km^2 - an impenetrable and protected rainforest the size of Wales.

It has long been suspected that the dense vegetation hides further remains of Mayan civilisation, but the search for them has proven difficult. In the days of Percy Fawcett, when researchers still struggled through the thicket with a machete, it was often pure luck when they came across old buildings. Many a ruin may have gone undiscovered because an expedition missed it by just a few hundred metres. Of course, more state-of-the-art methods have been available for a long time; for example, aerial photos. However, even photos of the region do not reveal much more than a dense ceiling of treetops. It was not until the application of laser technology that it was possible to look through the trees.

Complex Aerial Measurements

Light detection and ranging (LiDAR) uses laser light to measure distances. When the laser pulse hits an obstacle, the reflected light is detected by a detector. The exact distance to the obstacle can be calculated from the time between the emission of the pulse and the arrival of the returning light, which is referred to as time of flight (ToF) in technical jargon. This principle is familiar to every DIY enthusiast who has measured his or her home with a laser rangefinder before. This technology is also used in obstacle detection during autonomous driving or with self-piloting drones (Photonics News #PN60, pp. 8–9). One of the great advantages of LiDAR is its high resolution: Compared to other technologies, laser-based systems operate with very short wavelengths and can, therefore, record considerably more details.

Avalanche Photodiodes and Pulsed Laser Diodes for LiDAR Measurements

WEB UK61-0410

Pulsed laser diodes in the near IR range are commonly used in LiDAR cartography. Avalanche photodiodes (APDs) detect the reflected laser pulses. At our facilities in Canada and the USA, we manufacture both components in order to equip LiDAR systems for a wide variety of applications – not just archaeology.

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To create a digital elevation profile, the laser scans the landscape from an aeroplane or helicopter. Several thousand pulses are sent every second. In addition to LiDAR, two other technologies are used to determine the exact elevation profile: A satellite-supported GPS constantly records the exact geographical position of the aircraft so that the LiDAR measurements can be located later on the map. This happens in all three dimensions because the exact flight altitude naturally has a crucial influence on the ToF result. In addition, an inertial measurement unit (IMU) – essentially a gyroscope – measures the various angles of inclination of the aircraft since these directly influence the path length of the reflected laser beam.

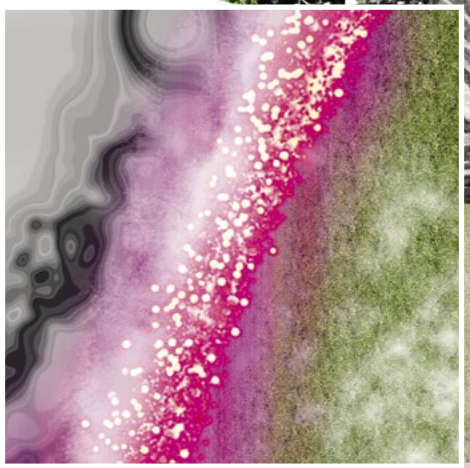
Trees Are Essentially Removed

Within trees and other plants, an effect occurs that is particularly useful in laser cartography. Unlike buildings or rocks, leaves do not reflect all light. One part penetrates the leaves and continues to move towards the ground until it hits the next "obstacle" and so on. Thus, it can happen that the same light pulse is reflected several times – each time with lower intensity and of course with continuously increasing ToF. All these reflected signals can be assigned later to the original pulse.

The result is a three-dimensional image of the tree – or even of an entire forest. Using complex algorithms, a computer can virtually remove vegetation from the landscape profile identified. What remains is a detailed model of the bare floor. The Maya researchers were surprised at how much new knowledge they were able to gain from the LiDAR data. The surface structures showed that hundreds of years ago houses, high roads, and fields once existed where the rainforest now grows. Until recently, it has been assumed that the hinterland of the Mayan cities was sparsely populated. Now the archaeologists know better: The metropolises were closely interlinked.

New Discoveries Everywhere

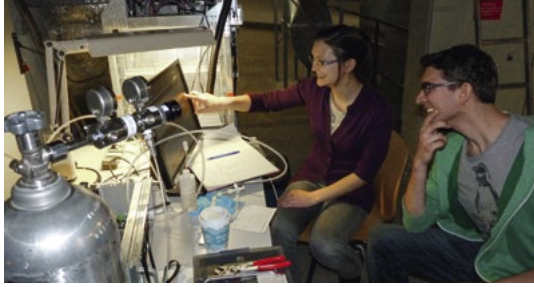
Not only in Central America does laser technology provide new insights into the past. In Lancashire, Cumbria and Northumberland, LiDAR investigations revealed ancient Roman roads. Archeologists had always expected them to be there, but no trace of them was visible on the aereal photographs they had worked with, up to now. At least, they know what they found. Their colleagues in Guatemala are far from that. They must first evaluate and analyse all data. It, therefore, remains very exciting. ■



Something's in the Air

Exciting or Funny?
Using Spectrometers to Measure Moviegoers' Feelings

Does a thriller smell different than a comedy? Of course not; after all, olfactory cinema has not yet been invented and emotions are created by images and sounds. However, it is now known that plants and insects pass on information via chemical substances. So, why wouldn't humans do the same as well? Scientists from the Max Planck Institute for Chemistry and the Johannes Gutenberg University of Mainz have investigated this question. For this purpose, they have chosen a place where many people feel the same feelings simultaneously: **the cinema.** ➔



© Air Chemistry Department
Max-Planck-Institut für Chemie

In school, we learn that the oxygen we inhale is converted into carbon dioxide in the body. Generally speaking, this is correct; however, our breath also contains other substances (i.e. so-called volatile compounds). Eight hundred and seventy-two of these substances are now known to scientists, some of which are produced by physiological processes in the body. This knowledge is used to measure changes in the body, for example, how the organism reacts to physical activity or certain foods. Strong emotions also trigger biochemical processes in the muscles, nervous system, and blood circulation. Prof. Jonathan Williams and his team from the Max Planck Institute for Chemistry in Mainz wanted to find out whether these reactions can be detected in the air we breathe.

100 Gases in 30 Seconds

A cinema offers the ideal setting for this project, especially because all viewers react to the film at the same time. This means that the measured values can always be assigned to a specific scene. In addition, the cinema halls are continuously ventilated: fresh air enters through openings under the seats, and the "used" air escapes through ventilation openings in the ceiling. Scientists installed several mass spectrometers at the openings and were thus able to measure the concentration of around 100 different volatile compounds at 30-second intervals. The continuous circulation also has the benefit that the composition of the air quickly returns to a normal level after the movie. This makes it easy to compare the results of successive measurements later on.

Over the course of one and a half months, the values were measured in two cinemas of a multiplex cinema in Mainz. During this period, films of various genres were shown. In addition to the usual comedies and action films, horror and children's films were also shown, and even a ballet performance was among them. The spectrograms of the individual curves were so characteristic that the researchers could often see with the naked eye which film was involved. In particular, exciting and funny scenes are clearly recognisable by the measurement curves.

Exciting and Funny Curves

"When the heroine fought for her life at the height of one of the action films, the values of carbon dioxide and isoprene in the exhausted air always rose significantly," explains Williams, "at each and every showing." This is important because this is the only way to produce reproducible (i.e. scientifically reliable) results. Isoprene is known for being released through muscle activity. One explanation for the increase in isoprene concentration in a seated audience could be that cinemagoers get tense, restless, and breathe faster during exciting scenes.

The fact that the clearest measurement results were achieved for "tension" and "humour" could be related to evolution. Certain substances are released from the body to signal to others that increased attention is required ("tension") or that it is time to relax ("humour"). The findings of the study can be advantageous in various areas. In medical breath gas analysis, for example, it is possible to determine whether a patient is in a stress situation and whether the results could be falsified. For audio-visual media such as commercials, films, and video games, the reaction of the test audience can be better evaluated by air measurements. ■

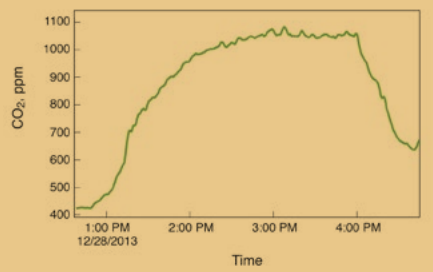
IR Spectroscopy for CO_2 Measurements

WEB UK61-0330

Scientists at the Max Planck Institute used proven IR spectroscopy to measure the carbon dioxide concentration in the cinema auditorium. Like other gases, CO_2 absorbs certain wavelengths of the IR spectrum. If the air is irradiated in the IR spectrum, a sensor can precisely determine the CO_2 content based on the absorption behaviour. The sensors are matched to the absorbed wavelength of 4.265µm.

Due to continuous air circulation, the CO_2 curve established in cinemas takes the classic shape of a "shark fin." The concentration in the air rises steeply after the start of the movie until it settles at around 1000–2400ppm. As soon as the audience leaves the cinema, it quickly drops again and approaches the starting value.

Carbon Dioxide (CO_2)



Pyroelectric detectors by LASER COMPONENTS are mainly used in high-resolution analytics and medical applications. ■

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New Products

1 **Detectors with IR Filters for NO_2 Measuring.** World First in Emission Measuring. ■
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Detectors with IR Filters for NO_2 Measuring

World First in Emission Measuring

WEB UK61-1330

LASER COMPONENTS is the first manufacturer to offer its pyroelectric detectors with narrow-band IR filters for NO_2 measuring (filter option V). This innovative change makes the challenging NO_2 measurement possible with non-dispersive infrared sensors (NDIR) - especially in combination with the company's differential pyros. Manufacturers of exhaust gas measurement systems will now be able to expand their devices by an additional IR measuring channel.

Up until now, the amount of NO_2 in exhaust gases has been determined by UV or electrochemical methods. Engine development was the only field using laser-based IR processes. The concentration of carbon compounds, on the other hand, has long been measured using NDIR. As a result, different techniques were applied for each type of chemical compound.

With these new NO_2 filters, LASER COMPONENTS strengthens its position as the IR detector manufacturer with the widest standard range of bandpass filters. ■

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SiC Photodiodes with Extended Wavelength Response

From "4H" to "6H" Response!

WEB UK61-0380

The long standing ifw Optronics UV photodiode series has been a work-horse detector for decades now. This is, in part, due to the high resilience of the active material, silicon carbide (SiC), with its wide band-gap proffering low leakage currents, superior radiation hardness, and temperature insensitivity. This makes these devices ideal for space, x-ray and harsh environmental applications since they are also light-weight, small and reasonably priced.

Ifw's existing JEA-series of photodiodes will now be joined with these new "Extended SiC" photodiodes, which allow detection up to ~ 400nm and so include the full UV-A, UV-B and UV-C spectrum.

While regular SiC with "4H" crystal structure shows reduced responsivity above 360nm wavelength, we now supply, as the only world-wide producer, "6H-SiC" material with extended wavelength response. Our new sensors are available with 0.05mm² and 0.1mm² active areas, TO5 and TO18 packages, and include optional integrated band pass optical filters. ■

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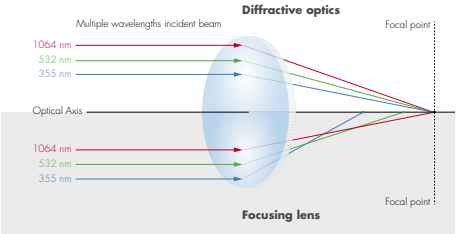
Diffractive Achromat Lens for Nd:YAG Laser Harmonics

One Optic–Three Wavelengths

WEB UK61-0031

Many applications can benefit using a single laser machine which can switch between different wavelengths for different processes with high precision and without interruption of continuous work. Using standard refractive focussing lenses results in chromatic aberrations and in some cases spherical aberrations. For some time achromatic doublet or triplet lenses have been used to overcome these issues in multi-wavelength systems. Although aberration issues are largely resolved, other issues are introduced. The optics themselves are bulky, and due to the range of materials used and the bonded interfaces, can be susceptible to thermal focal shift and lower laser damage thresholds.

There are currently no effective refractive achromats available for the triple wavelengths 355nm, 532nm and 1064nm. The diffractive achromat from Holo/OR offers diffraction limited performance due to the absence of aberrations, while maintaining high laser damage threshold and low thermal sensitivity.



Performance is optimised for all design wavelengths so that the operating wavelength may be switched and the system will continue to operate without focal length shift with no need for further adjustments.

Standard triple wavelength diffractive achromats offer a focal length of 150mm for the Nd:YAG harmonics 355nm, 532nm and 1064nm, and are available on short lead times. Other focal length and wavelength values are possible upon request. ■

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IBS Mirror Coatings

Greater than Four 9s!

WEB UK61-0010

Alongside our industry familiar E-beam coatings, offered since 1986, LASER COMPONENTS now has Ion Assisted Deposition (IAD) and Ion Beam Sputtering (IBS) coating capabilities. Being an extremely precise and highly replicable method, IBS coatings are used for the most spectrally demanding applications, such as steep edge dichroic mirrors and very broad band mirrors. Unlike other coating technologies, process parameters such as beam energy, layer growth rate and oxidation level, can be individually regulated to a high precision during the coating process. The result is an optical coating with high density and extremely low thermal drift, due to the absence of moisture retention.

IBS coatings exhibit low scattering losses and extremely high reflectivities, greater than 99.99% depending on optimised wavelength. This is a 'cold' coating method, and thus is suitable for temperature and moisture sensitive substrates. LASER COMPONENTS offers custom IBS coating in the wavelength range 248nm to 3000nm. ■

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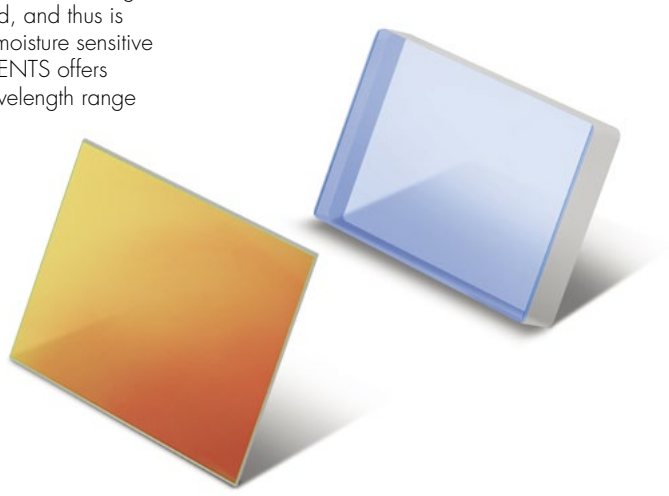

WaveEye - Precise Wavelength Measurement

Compact Measuring Device

WEB UK61-1770

The portfolio of LASER COMPONENTS now includes WaveEye, a particularly compact and versatile wavelength measuring device for cw or quasi-cw lasers between 450nm and 950nm. The measurement data is available at a rate of 1kHz without any warm-up delay. It can be used for an optical input power range between 0.1µW and 1mW. The digital measured value output is carried out via a USB connection, which also serves as a power supply. In addition, the wavelength information is available as voltages of up to 4.096V at the analogue output. The WaveEye has an easy to use software or can be operated by simple serial text commands.

Due to its small size, the WaveEye is suitable as an OEM component for a variety of applications, such as tuneable lasers or as part of a larger measuring device. ■

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Optical Modulators for Distributed Fibre Sensors

MXER-LN

WEB UK61-0960

LASER COMPONENTS offers optical modulators (MXER-LN) in the range of 1530nm to 1625nm dedicated to fibre sensing applications. Such applications require a very high extinction ratio as it is a key parameter. Our partner iXblue has developed these optical modulators based on Mach-Zehnder with an extinction ratio of > 40 dB and beyond to guarantee a good functionality of these applications.

To accommodate our customers in this field, iXblue has also patented a specific waveguide design to ensure a low insertion loss. The titanium technology used for these waveguides guarantees a high and long-term stability of the modulator bias drift.

These products are designed to be integrated into such sensor instruments to service the sensor market based on BOTDA (Brillouin Optical Time Domain Analysis) which relates to distributed sensors of temperature and strain in fibre cables installed along civil engineering structures (bridges, dams) and particularly along pipelines.

These modulators, based on Mach-Zehnder lithium niobate technology, can have two functions in the core of the instrument. They can generate the initial optical pulse of the pump, and they can generate the dual side band modulation with carrier suppression (CS-DSB) of the probe. ■

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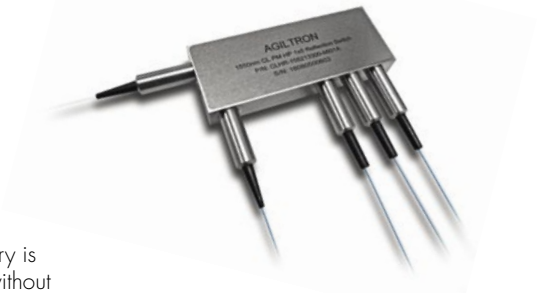
Fibre Optic Switch for LiDAR Applications

Separate Port for Reflected Signal

WEB UK61-0145

LASER COMPONENTS presents the Agiltron CrystaLatch (CL) series of optical switches that are specifically designed for sensor and LiDAR applications. The CL 1x6 switch assigns the incoming signal to one of the six available output ports and simultaneously detects the reflected signal via a dedicated sensor port. It is designed for permanent, fail-safe live operation under strong vibrations, and works perfectly even at temperatures of -40°C.

A magneto-optical solution is applied to minimise optical signal losses. The circuitry is carried out in a patented configuration without mechanical components - the integrated circulator is activated via an electrical control signal. Due to the latching function (flip flop), the selected optical output remains active even after the driver signal is switched off.



Thanks to their low insertion loss, the CL switches are highly efficient. ■

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Precise Positioning over Long Distances

FLEXPOINT® Long Range Laser Module

WEB UK61-0740

With its FLEXPOINT® Long Range Line Module, LASER COMPONENTS has developed a highly-precise positioning tool for long distances. Even at 50m, the line is only 4m long and can be adjusted to line widths of a few millimetres with an easy-to-use focusing device. The FLEXPOINT® LR-L module is available with red (660nm) or green (520nm) lines.

Customers have the choice of any output power in a range between 5mW and 30mW.

Using the optional battery packs, the laser module can also be operated without a power line - for mobile use. A special precision mount allows for exact beam alignment along two axes.

The Long Range Module is ideally suited for tunnel construction, alignment of large machines, or other adjustments over long distances. ■

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Gap Measurement Using Line Lasers

FLEXPOINT® MVnano

WEB UK61-1740

The presence and size of gaps can have a big impact on the performance of products especially in the automotive, aerospace and transport industry. Traditional methods of gap measurement involve mechanical tools such as taper gauges, slip gauges and Vernier callipers. These have numerous shortcomings such as low repeatability, the skill required to use them, the need to record measurements and the risk of damage to the measured parts.

The MVnano range of line laser modules is an ideal component when designing a non-contact, quick acquisition and data logging sensing instrument. When viewed by a linear detector array or camera the projected laser line is absent across the gap. Once calibrated the absent image can be assigned to the physical width of the gap.

Whether measuring components of a car door, an aero engine blades or escalator steps, to measure and record the gap between components can significantly improve efficiency, reliability and improve noise reduction. Monitoring such gaps utilising the LASER COMPONENTS' line laser FLEXPOINT® MVnano series aids for such improvements in a much quicker and less skill intensive way than would have been possible using other means.

The benefits of being able to quickly and accurately measure and record gaps is evident for many industries beyond the above and can see a growth in the number and variety of those utilising the solution realised through our line laser modules. ■

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New IR Sensor Cards

Optimised Performance and Resolution

WEB UK61-0510

LASER COMPONENTS has added three new models to its portfolio of IR sensor cards:

- **LDT-007BN** for low-power Nd:YAG lasers converts IR radiation of 700nm to 1400nm into visible red light of 654 nm.
- **LDT-1064CN**, made of resistant ceramic, is suitable for high-power IR lasers (900–1100nm) up to 200 W/cm². The active area of 60mm x 40mm can be used up to the edge.
- **LDT-1064N** offers a particularly large active area of 50.8mm x 50.8mm which allows it to make the invisible radiation of IR lasers (800–1700nm) with larger diameters visible as green light (530nm).

All screens are immediately ready for use and do not have to be activated. LASER COMPONENTS can provide samples upon request for tests in practical applications.

Sensor cards, also known as conversion sheets, convert invisible radiation into visible light when held directly into the laser beam. They are essential for the alignment and focusing of IR and UV lasers. LASER COMPONENTS offers sensor cards for a large range of wavelengths and power levels. ■

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Photonex Europe
October 10–11, 2018
Ricoh Arena, Coventry
Booth D15

SPIE. Photonics West
February 05–07, 2019
The Moscone Center
San Francisco, CA, USA
Booth 1751

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