PHOTONICS NEWS

Company Newspaper of the LASER COMPONENTS Nordic AB

lasercomponents.se
#11 ▪ 03|2020

Quantum Communication

Photonics in Space

Quality Assurance

New Products

Editorial

Dear reader,

This is the 11th issue of Photonics News Nordic, but for me it is the first since I joined LASER COMPONENTS a few months ago. I find the world of photonics very interesting and enjoy our daily business where I meet customers with tons of exciting applications in many different fields and markets. With my roots in optical physics and twenty years in sales and management expertise in the electronics and manufacturing industries, I am looking forward to lead and further develop our organization. One of my main goals is to continue growing the business of in-house developed products such as custom-made optics and fiber optic assemblies as well as standardized optoelectronic components. As you all know, our own strong product portfolio is complemented by high-end products from strategic suppliers. We strive to provide customer-oriented solutions and establish long-term business relationships with our customers and partners in the Nordic region.

One of the topics in Photonics News No. 11 is photonics in space. The aviation and space industry in Sweden, Finland, Denmark and Norway is well established. We have in our region many internationally recognized companies active in research, development and production in most aerospace segments. This includes engine production, avionics, space applications, communication, and measurement systems. New challenges such as sustainable air travel or eco-friendly space exploration require lighter, faster and more efficient planes and space launch vehicles. These aircrafts of the future drive new demands on engineering, product design, and manufacturing.

The aerospace industry uses photonic technologies for a wide range of applications. The high functionality required under extreme conditions push the boundaries of innovation. In this issue, we will get some examples of how laser technology and optoelectronics play an important role in many areas of the aerospace industry today and in the future.

Enjoy reading!

Yours,

Fredrik Wikfeldt
CEO, LASER COMPONENTS Nordic AB

Content

LASER COMPONENTS

Imprint

LASER COMPONENTS Nordic AB
Skårs led 3
41263 Göteborg
Sweden
Tel: +46 31 703 71 73
Fax: +46 31 703 71 01
www.lasercomponents.se
info@lasercomponents.se

What Keeps us Flying

Measuring Large Engines for Small Gaps

Nowadays, turbines are the most common means of propulsion for commercial airplanes. After decades of research and continuous optimization, the turbofan has established itself as the most efficient turbine engine for speeds between 500 km/h and 1000 km/h, which is the most common travelling speed for commercial jet airplanes. ➔

They only seem to be a small part of the plane when you see them attached to the wings, but standing on their own, they are gigantic pieces of technology. The fan of an Airbus 350 engine, for example, has a diameter of 3 meters – almost twice the size of the average human. These fans are among the most prominent – and most important – parts of the entire engine. It is their job to "suck in" the air, which is then compressed and accelerated by the turbine to produce the jet stream that makes the airplane fly.

Development and construction of aircraft engines is a time-consuming and expensive process. Therefore, airline companies try to keep them in operation as long as possible. Runtimes of 30 years are common. To allow this, the demanding security standards of the airline industry demand each turbine to undergo a strict maintenance schedule. In 2015, almost 25 billion US-Dollars were invested in maintenance, repair and overhaul (MRO) of aircraft engines. Experts claim that this sum will reach 46 billion Dollars by 2025. Still it is more cost-effective to invest in MRO instead of replacing older engines with new ones. It goes without saying that the highest quality standards apply for such a vital piece of technology. Construction and maintenance demand the utmost precision.

With parts as carefully designed as turbine fan blades, any deviation from the original layout may have grave consequences. At the same time, they are among the most highly stressed parts of the engine. Even though they are made of the lightest possible materials their considerable weight and rotation speeds of several thousand rounds per minute make them subject to huge centrifugal forces. Even small particles may cause substantial damage and during flight they are often exposed to harsh environmental conditions such as sub-zero temperature. Humidity and the sulfurous residues of fuel combustion lead to an increased danger of corrosion. All these factors may cause the blade to lose its initial shape.

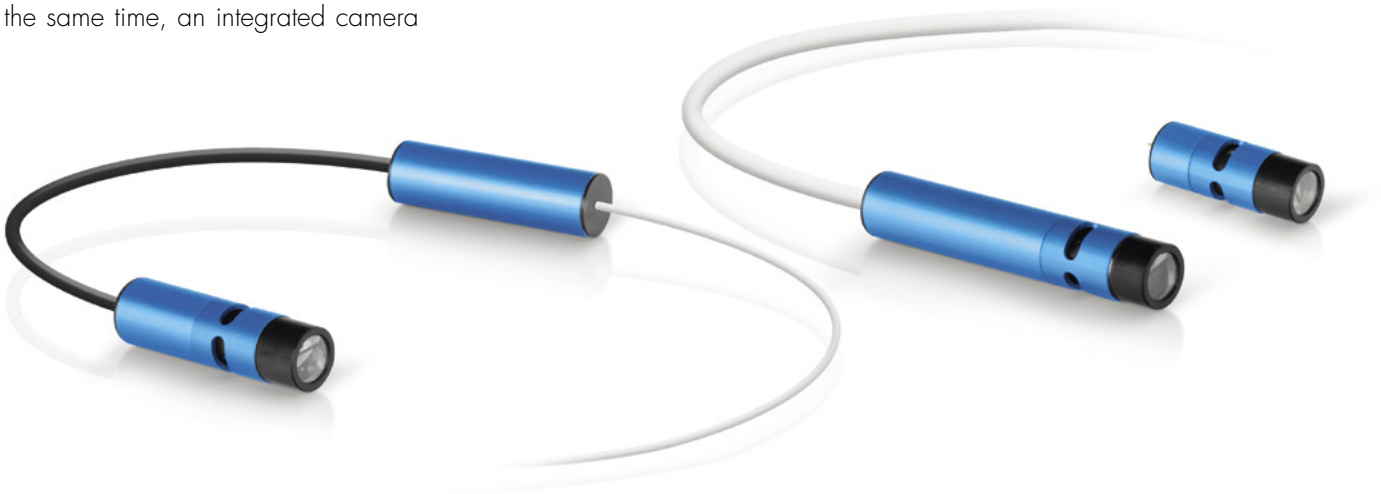
The slightest change in the clearance gap between the fan blade and the surrounding casing may cause inefficiency, unreliability and noise production. Until recently, this distance was measured by hand using a slip or taper gauge. Naturally, this method was time-consuming and prone to inaccuracies. More accurate and consistent results can be obtained using the laser-based GapGun. British specialists at Third Dimension developed this specialized gap measuring tool using MVnano line laser modules by LASER COMPONENTS. It has been successfully deployed by leading aeronautics engine manufacturers for both gap and surface measurements. It is also possible to take radius measurements on the

The portable gap measuring system GapGun with laser triangulation considerably reduces the working time and the costs of the manufacturing processes.

trailing and leading edges of the blade – including form measurement. The output from the GapGun can be a simple go/no go decision, as recorded measurements are compared to acceptable limits, or the profile can be exported as a point cloud, which may be imported into a CAD program to compare measurement data to the nominal values. In industry applications reliability and repeatability of the results were thus improved by a factor four.

Originally designed as a portable device for quick gap measurement, the GapGun is based on laser triangulation. A laser stripe is projected across the surface of a part to determine the measurable feature. At the same time, an integrated camera system takes images of this static laser line from different angles. Using the known angle between the camera and the projected laser, combined with a range of proprietary optical tuning and analysis steps, the GapGun software calculates the dimensions of the surface covered by the laser. The measured data points form a digital copy, which is then used to analyze the measured surface, instantaneously comparing it with tolerance bands, logging against serial numbers and transferring to a data store. Because a laser is a clean form of structured light, and the recording process is automated, measured data is highly reliable and can be used as a reliable source for quality control and process analytics.

When it comes to aircraft engines, the same method is applied at a fixed position, which allows for the highest possible level of repeatability and consistency. Besides from engine blade measurement, the aerospace industry also uses the GapGun to check welds, as well as the fit of panels in airplane structures for inaccuracies that could cause aerodynamic disturbances or worse: quality problems. ■



Modern Measuring Tools for Industrial Production - FLEXPOINT® MV Series for 3D Image Processing

In Germany, LASER COMPONENTS manufactures custom laser modules; in fact, a special series was developed for use in industrial image processing: the FLEXPOINT® MV series line lasers. FLEXPOINT® laser modules provide the transport industry with new solutions to old measuring problems in production. They are also used as alignment aids and for non-contact measurement. In combination with cost-effective detectors, cameras, and a simple software, laser technologies lead to precise and reproducible measurements in a short amount of time. Where taper or slide gauges were once used, a single instrument is now sufficient for sustainable measurements.

The FLEXPOINT® MV series laser modules include a wide range of product families that have one thing in common: they are available in three different versions. In addition to the standard module, in which laser optics, laser diodes, and electronics are combined in one housing, it is often necessary to physically separate the optical and electronic elements due to space reasons. Some customers even dispense with factory control electronics in order to conveniently integrate the laser module into their own electronics.

The manufacturer can meet all demands and build the desired versions individually according to the wavelength, power, and beam profile specifications. In order to withstand harsh industrial conditions, the housings are certified up to IP67 (i.e., they are dustproof, preventing the penetration of foreign bodies, and waterproof if immersed only temporarily in water). ■

WEB N11-074

Svante Karlsson: +46 704 548 306
s.karlsson@lasercomponents.se

Photonic Communications

Single Photons are Paving the Way for the Future

Many consider quantum computing the gateway to a new world of fast-thinking, intelligent computers. While classic computers process information as bits, quantum computing uses so called qubits. As a comparison, the classic bit may be represented by a coin that can only show heads or tails, whereas qubits are more like a coin that spins while it is being tossed. In addition to the equal probability of ending up on either side, it also has other properties such as the spinning speed, the direction it spins, the angle of the spinning axis, and so forth. All these properties may be used to carry data – but only for as long as the coin is spinning. As soon as it lands on the ground it will once again end up with one side up, and the exciting qubit turns into a boring old bit.[1]

Secure Data Transfer

While IBM, Google, and their respective research networks are working on augmenting quantum computing, others have set their eyes on another aspect of the quantum future – namely how it may affect cybersecurity and data encoding.

Quantum computing poses a potential threat as it is capable of rapidly decoding existing encryption methods. One readily available solution is quantum key distribution (QKD).

The first theoretical principles of quantum encryption have been established as early as the 1980s. Most commonly, single photons are randomly put into distinct states of polarization that are transmitted from an information source (Alice) to a recipient (Bob), where they are re-transferred into digital information.[2]

One of the most secure forms of establishing a trusted connection between Alice and Bob is the use of entanglement. Roughly speaking, there is a magical band between a pair of photons created as twins, which causes one of them to behave exactly like the other – even if they are miles apart. Scientists call this "spooky action at a distance". With one entangled photon transmitted to Bob, while the other returns to Alice, both the data and code information can be transmitted at the same time.

1 https://www.sciencealert.com/quantum-computers
2 https://en.wikipedia.org/wiki/Quantum_key_distribution

SpooQy-1: Singapore's experimental quantum CubeSat for testing a source of entangled pairs of photons.

Long-Distance Communication Challenges

Using modern fiber technology, QKD may be applied today, but only on a metropolitan level. Due to the optical attenuation of fibers, the signals can only be transmitted for a few hundred kilometers before they are degraded into indistinguishable blabber.

In legacy technologies, optical or electronic repeaters are used to overcome these obstacles; however, on a quantum level these technologies are not likely to be available within the next few decades. Unlike with radio transmissions, the free-air transmission of optical data relies on the so-called "line of sight", which is the uninterrupted line between the sender and the recipient. Therefore, scientists are once again setting their minds beyond the confines of our planet. The attenuation of the atmosphere is far lower than that of an optical fiber. This means that effective communication is possible over significantly longer distances, given suitable sensitive single photon detectors.

An entangled quantum code generated by a satellite in Earth's orbit could be transferred to both Alice and Bob, as long as they are both within reach of the satellite. In 2017, the Micius satellite of the Chinese Academy of Science was successfully used to transfer a traditional quantum code from China to Vienna, Austria. At the National University of Singapore, scientists are currently working on an entangled quantum encryption device that will fit into a small so-called nano-satellite cube of 11.35 cm × 10 cm × 10 cm. The aptly named SpooQySat, in operation since June 17, 2019, currently serves as a live demonstration of an entangled photon source in space.

Down on Earth, the detectors on Bob's side have to be able to filter out a single encoded photon from all the surrounding background noise. Usually, scientists employ single photon avalanche diodes that absorb incoming photons and transfer them into electrical signals. Their quality is defined by their quantum efficiency and the ability to block out the background noise. ■

Every Photon Counts

Fundamental Research Supported by Highly Sensitive Measurement Tools

WEB N11-029

In quantum information processing, many experiments are conducted in a wavelength range of around 810 nm, which is where silicon avalanche photodiodes (APDs) are most efficient. Under the brand name COUNT® NIR, LASER COMPONENTS offers a plug-and-play module with a notable detection efficiency rate of 50 % at 810 nm – almost 80 % at 700 nm – and extremely low dark count rates of < 50 cps. The device is based on a single-photon avalanche photodiode (SPAD) designed in house that operates in Geiger mode to detect extremely weak light signals.

All in one, COUNT® NIR offers researchers a versatile set of features that combines high photon detection efficiency, a high dynamic range, and ease of use for the most demanding photon counting applications. ■

Harvey Washbrook: +46 708 770 679
h.washbrook@lasercomponents.se

Application Fields for COUNT® Modules

How Quantum Cryptography Works

Data security and data exchange are topics with increasing importance. How do you prevent data from being intercepted by a third party? The solution lies in cryptography: The message must be encoded. But what if the key exchange is intercepted? This is where quantum crytography comes into play.

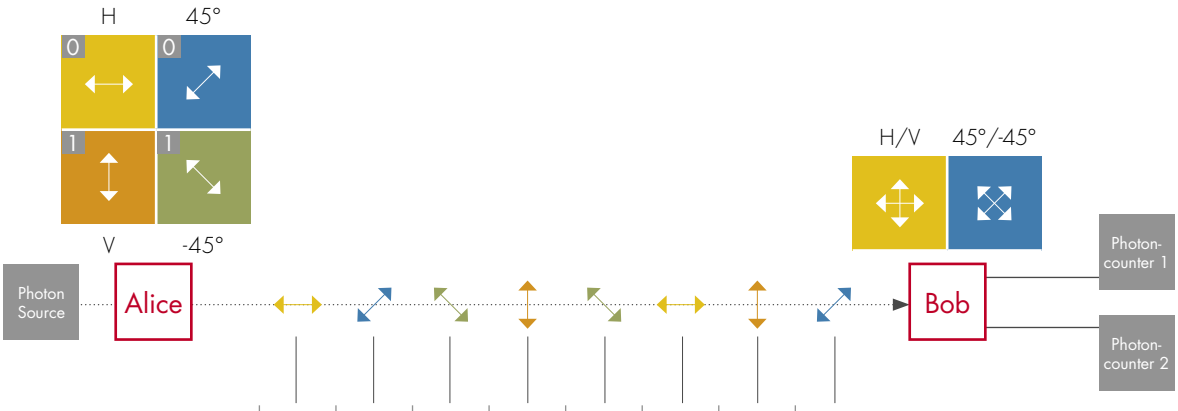
The fundamental idea behind so-called quantum key distribution (QKD) is to use single photons instead of entire photon bundles. This way an eavesdropper (referred to as "Eve" in quantum mechanics) cannot simply divert the photons that are sent from Person A to Person B (referred to as "Alice" and "Bob," respectively, in quantum mechanics). Eve would have to copy and then detect the photons to prevent the interception from being detected by Bob. This is precisely what quantum mechanics renders impossible (the so-called "no cloning theorem").

Figure 1 (page 008) depicts what key generation for coding and decoding data can look like. This so-called BB84 protocol (developed by Bennett and Brassard in 1984) uses the polarization of photons as a means of generating a key sequence. Alice selects one of four polarization states – H (horizontal), V (vertical), +45°, and -45° – and sends such a photon to Bob. She must first indicate which bit value the two orthogonally arranged polarization states have: 0 or 1. In our example, H corresponds to 0, V corresponds to 1, 45° correspond to 0, and -45° correspond to 1. If Bob receives such a photon, he decides whether to measure based on H/V or 45°/-45° and ultimately makes a note of the polarization state (and thus the bit value) of the photon. Bob communicates with Alice in the classic sense, and they compare their base selection. This information, which is of no use to Eve because she does not know the exact results, is sufficient for Alice and Bob to determine which bit values they can use for their key[1] .

A further development of the BB84 protocol uses entangled photons, which strongly correlate in their properties, that are sent from a single source to Alice and Bob simultaneously.

One such source was developed, for example, by experimental physicists in Prof. Weihs' photonics group at the University of Innsbruck: a pulsed Sagnac source of polarization-entangled photons[2] . Here a nonlinear crystal is used that produces two lower-energy photons at a wavelength of 808 nm from a higher-energy photon at 404 nm. The photons are detected using two "COUNT" SPADs by LASER COMPONENTS.

1 for more ilnformations see also http://www.weltderphysik.de/gebiet/technik/quantentechnik/quantenkryptographie/
2 http://www.uibk.ac.at/exphys/photonik/people/parametric-downconversion.html
3 http://arxiv.org/abs/quant-ph/0702262
4 http://arxiv.org/pdf/1008.4593v2.pdf
5 http://arxiv.org/abs/1109.1473



Alices Bit	0	0	1	1	1	0	1	0
Bobs Base Selection	✥	✥	⤫	⤫	✥	⤫	✥	⤫
Bobs Bit	0	1	1	1	0	0	1	0
Key	0	–	1	–	–	–	1	0

Representation based on www.teilchen.at

Fig. 1 Schematic diagram of the quantum key exchange between Alice and Bob

As secure as these methods are in theory, in practice there is a lot of room for error. The most significant sources of error are the single photon detectors that Alice and Bob use. In theory, the available detectors are perfect, identical, and have a detection efficiency of 100%; however, in practice, this is never the case. It is precisely this discrepancy in the detection efficiency of two detectors that quantum hackers use to access the key[3]. An alternative method "blinds" the SPADs with the help of a light pulse and uses the "blind time" of the detector to intercept information[4].

Thanks to the identification of sources of error by quantum hackers, research groups have been able to work on approaches for solutions to these problems and develop a "measurement unit-independent" version of the QKD[5]. The industry can also contribute to making the methods more efficient and precise. The constant exchange between research and industry is thus extremely important. ■

Secure Communication in Government Organizations

With QuNET, a project was initiated by the Federal Ministry of Education and Research (BMBF) in May 2019 in which a pilot network for quantum communication is being developed and set up in Germany. The goal of this project is secure communication in governmental and administrative agencies, in which every attempt at interception is safely detected. Research in quantum technology is already at the international forefront. In this legislative period, the federal government is providing 650 million euros for further expansion. ■

Link:
https://www.bmbf.de/de/sicher-kommunizieren-mit-quantentechnologie-8682.html

Long-Lifetime Laser Diodes for Space

Adam Erlich, Sheaumann Laser Inc.

WEB N11-145

Lasers must achieve specific design requirements to survive the rigors of space and still be cost-effective.

There has been a flurry of announcements in the news recently about low-Earth-orbit satellite constellations, which are primarily expected to be able to provide wideband internet anywhere in the world. Many of these satellite networks will require lasers that are cost-effective and able to survive the rigors of space. Missions to the moon and planets typically require high bandwidth to accommodate such scientific demands as hyperspectral imaging. To provide sufficient power and signal strength to ground stations, custom high-power laser diodes may also be necessary for some space missions. Consequently, long-lifetime lasers for harsh environments are becoming increasingly important. There are several key factors related to designing a laser module for long life in space.

The Rigors of Space

The extreme environmental conditions found in space push the physical limits of nearly every scientific technique, process, and component. For a spacecraft to succeed, all components, including lasers, must not only survive these conditions but maintain performance as well. Space organizations will frequently choose a laser based on its ability to penetrate the atmosphere and transmit through water vapor. Coincidentally, these wavelengths are similar to traditional telecom wavelengths, but standard telecom packages are not designed for the rigors of space.

When lasers travel into space, they may be required to operate for two-plus decades without repairs or recalibration. They will be exposed to temperatures ranging from -55 to 85°C, from the chilling darkness behind the Earth to the extreme heat of the sun. They will also be exposed to high mechanical stresses, including severe shock and vibration. Designing a laser for success in space is particularly demanding because size, weight, and power must be as small as possible to minimize launch cost.

Thermal cycling is an area that challenges laser manufacturers because the different thermal expansion coefficients between the materials within the package can result in varying power levels coupled to the fiber. Over time, these differing expansion rates cause the package to shear itself apart. The ability of the laser to prevail and survive in a hostile environment depends on reworking the way a diode laser chip is designed and mounted within a package. Long-lifetime lasers are required to survive thousands of temperature cycles; even military-grade laser diodes typically cannot survive more than 500 cycles. Ultimately, the characteristics of space provide the ideal environment to test and perfect extreme reliability.

When lasers travel into space, they may be required to operate for two-plus decades without repairs or recalibration.

The Metal Stack

In a typical laser diode design, there are several layers of various metals and solder between the laser chip and the package. The solder connects the chip to a submount, which is connected by another solder to a base mount, which in turn is connected to the package by another layer of solder (Figure 1). Each layer represents a potential thermal expansion mismatch, and when subjected to extreme cycling tests, the metal matrix of the solder can break apart.

Thus, materials should be selected based on three key criteria:

1. high thermal conductivity to remove heat from the die;
2. compatible thermal expansion through the metal stack; and
3. material strength to maintain structural integrity under high shock and vibration.

Through effective design, thermal stress between the layers can be minimized. This type of laser module is able to survive over 2000 temperature cycles and the high g-forces and vibration profiles associated with launch.

The Laser Chip

When lasers travel into space, they may be required to operate for two-plus decades without repairs or recalibration.

An essential part of achieving long lifetime is optimization of the thermal performance of the die itself. If a chip becomes too hot, it will be stressed and burn out over time. The better the heat dissipation, the longer the life of the laser.

Designing the best metal layers and thicknesses to avoid high thermal impedances between the layers is critical. It requires multiple layers of metal to be deposited on the gallium arsenide (GaAs) chip that thermally couples the die to the solder and connects it to the submount (Figure 2). If layers are not correctly chosen, heat reflects back to the chip. Although modeling tools are available to help with this task, decades of experience are necessary to master this art; the technique is so subtle, it has not been fully captured in modeling tools. The chip must reliably operate at very high junction temperatures.

Performance

In addition to surviving the harsh environment, the laser module must also maintain its optical performance. Thermal expansion moves the fiber relative to the aperture of the die and reduces the light coupled into the fiber. To maintain consistent power into the fiber, the system must be made less sensitive to this movement.

One novel approach to reduce sensitivity requires a change to the quantum well structure of the die to alter how the light is emitted from the aperture. This results in higher coupling into the acceptance angle of the fiber.

An in-house packaging and laser die design system can enable the creation and fabrication of unique die structures. By altering the physical properties of the beam emitted from the die, it is possible to maintain consistent power into the fiber across the required temperature range.

Hermeticity

Beyond thermal management, package hermeticity also represents a challenge. High levels of hermeticity are directly related to laser lifetime. Telcordia specs are two orders of magnitude lower than what is required for a laser to survive for 25 years in space. One way to achieve these levels is with a novel process that seals the snout of the package together. The ability to test the package for fine and gross leaks at these levels requires advanced procedures.

Because innovation is required for a laser module to succeed in space, traditional design rules will need to be broken and the designs remade from scratch. A company's ability to alter its laser diode design and fabrication, along with its ability to process and package in-house, are keys to success. ■

Adapted from the August 2019 issue of PHOTONICS SPECTRA

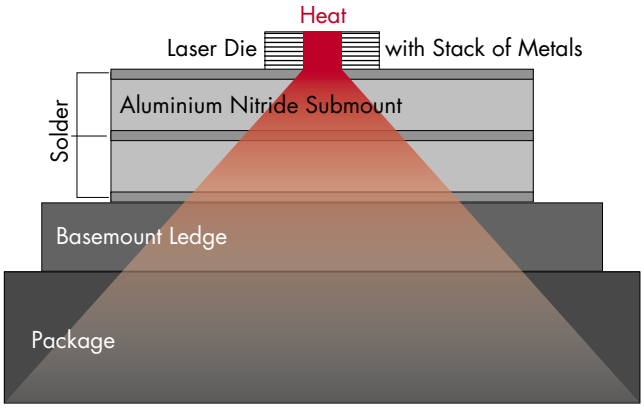


Abb. 1: Die, Submount und Gehäuse

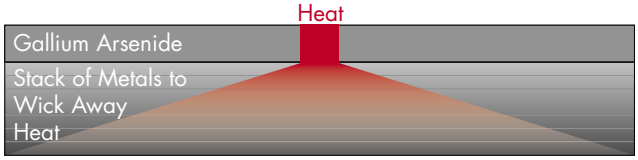
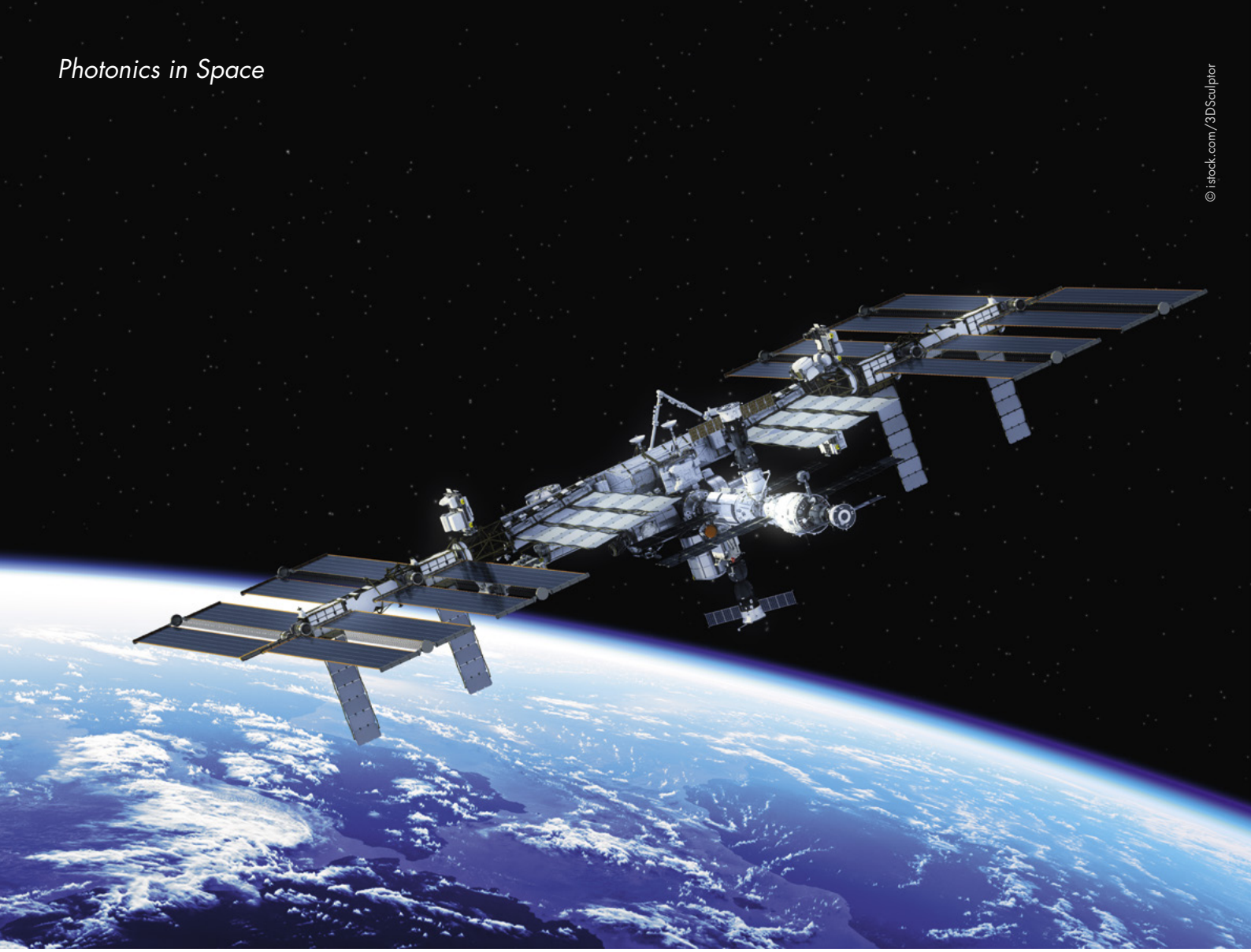


Abb. 2: Detaillierte Ansicht des Laser-Dies



Fiber Optics in Space

Optical Switch Proves its Worth Aboard ISS

WEB N11-011

All components for use in space must undergo intensive and detailed testing until their space suitability can be determined. The qualification of equipment and components for space missions is, therefore, a long and costly process. To reduce the mission risk, it is useful to have a so-called technology demonstrator, to be tested early and under real conditions. One current example of this is a fiber optic switch supplied by LASER COMPONENTS to the space company OHB, which was qualified for a space experiment aboard the International Space Station (ISS). In the future, it will be used in an Exobiology Facility.

Space Research

The European Space Agency is developing a novel Exobiology Facility to be accommodated outside the International Space Station (ISS). Exposure platforms like the Exobiology Facility in Low Earth Orbit (LEO) – with the possibility for long-duration solar exposure – are ideal for investigating the effects of solar and cosmic radiation on various biological and non-biological samples. Up to now, the exobiology and space science research community has successfully made use of the ISS via the EXPOSE Facility to expose samples to the space environment with subsequent analyses after returning to Earth.

The new platform will combine the advantages of the ISS, i.e., long-term exposure and sample return capability, with near-real-time in-situ monitoring of the chemical or biological evolution of samples in space. In particular, ultraviolet-visible (UV-Vis) and infrared (IR) spectroscopy are considered to be key non-invasive methods for analyzing the samples in situ. To acquire the spectra of many samples, which are necessary for statistical reasons, one of the key instruments is an optical fiber switch, combined with the ultraviolet-visible spectrometer.

Optical Technology Demonstrator

SPECTRODemo has been developed as a precursor demonstrator to increase the maturity of the complete optical chain, i.e., the fiber switch and spectrometer. The payload was launched on April 17, 2019 and operated continuously until August 9, 2019. The technology demonstrator was operated aboard the ISS within the ICE Cubes Facility – a small modular container which measures 2U×2U, where 1U=10×10×10cm^3.

The demonstrator provides useful information for the upcoming development of the Exobiology Facility flight model, especially with respect to the operation, durability, and reliability of the fiber switch.

In the fiber switch concept, each cell is associated with its own dedicated multimode optical fiber. A switch unit is used to select the fiber that is measured by the spectrometer, which allows a higher flexibility in sample handling in a compact design. The configuration of SPECTRODemo supports continuous acquisition across six channels, with each channel recording a spectrum from a defined LED source through a calibrated neutral density filter with a fixed absorbance value.

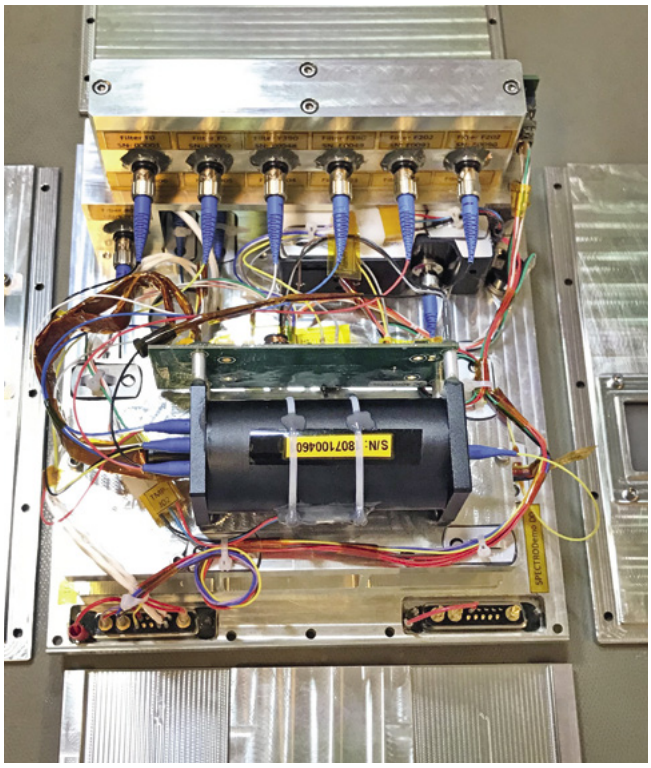
The main objective is to assess the reliability of the system and potential modifications to assure repeatable measurements and suitability for the harsh environment of space. Consequently, an environmental test campaign was performed to evaluate whether critical components can survive the launch and the space environment. The fiber switch underwent vibration and shock testing and passed successfully. Additionally, the device experienced a thermal-vacuum test in which the setup was connected electrically and optically to equipment outside the chamber to verify the system performance during testing. Overall, eight cycles between -25°C and 60°C were performed. Performance was measured at extreme temperatures, without exhibiting any malfunctions in this case as well.

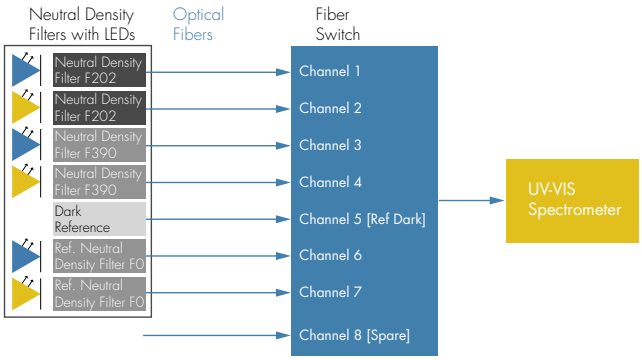
What's Next?

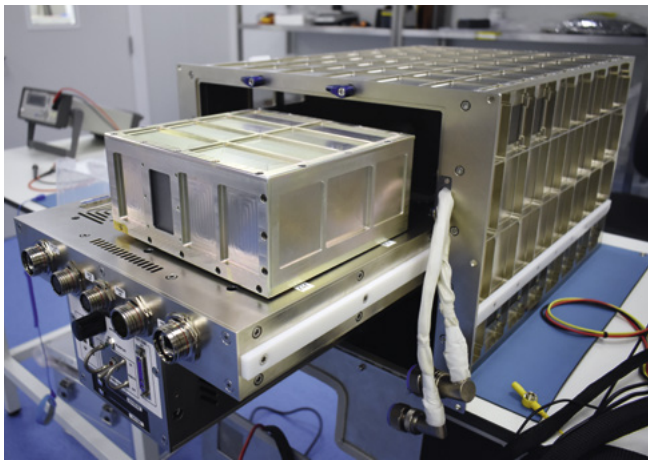
The payload returned to Earth on August 27, 2019 via Space-X 18. Since then, further investigation has been performed at OHB, mainly focused on the improvement of the stepper motor chain and high vacuum lubricants for a more accurate acquisition and calibration position repeatability. Furthermore, the fiber switch assembly, including the electronic board, will be assessed versus the radiation environment to determine the degradation of the optical components (e.g., fibers) and the suitability of the electronic parts.

The next step will be the development of a customized version with 1×55 channels to be used for the Exobiology Facility. ■

Internal structure of the SPECTRO Demo:
a demonstrator of optical technologies for space research.







New Products

Gentec-EO's Pronto Series

More Variety Thanks to Firmware Update

WEB N11-071

With its latest firmware update, Gentec EO has made its portable Pronto series measuring instruments even more versatile and flexible: In addition to the existing manual control, they can now also be operated and controlled as permanently installed measuring setups via their USB interface. This opens up new fields of application – for example, in cyclic power control in laser systems.

To date, many of these functions have only been able to be implemented using considerably more expensive solutions. In addition, the costly water cooling required for most larger systems is no longer necessary.

The data for the update can be downloaded from the Gentec EO website. The communication parameters and all available commands can be found in the user manual of your Pronto device. ■

Harvey Washbrook: +46 708 770 679
h.washbrook@lasercomponents.se

Infrared Laser Diodes in an SMD Package

Reliable Laser Sources with Good Temperature Properties

WEB N11-049

For the NIR wavelength of 940 nm, Arima has started, for the first time, offering two laser diodes in SMD housings. The ADL-94Y01IY-F1 and 94Y01EY-F2 versions both differ in their housing design. With a footprint of 3 mm x 3 mm (IY-F1) and 3.5 mm x 3.5 mm (EY-F2) and a height of just 0.75 mm, they deliver 200 mW of optical power.

At temperatures of up to 50 °C, they feature consistently high performance. The laser diodes are primarily designed for distance measurement, 3D sensor applications, and pumping fiber lasers. ■

Svante Karlsson: +46 704 548 306
s.karlsson@lasercomponents.se

White Light Laser Sources

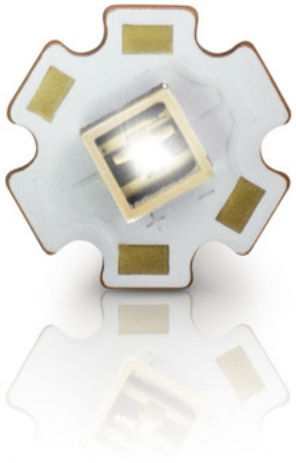
SMD Laser Sources with 450 Lumens

WEB N11-045

The LaserLight SMD now offers manufacturers of semiconductor-based lighting solutions a powerful white light source for directional light. With more than 1000 Mcd/m², this light source can achieve a luminance of up to ten times higher than ordinary white LEDs. This enables particularly efficient lighting solutions with a small form factor. In combination with a 35-mm optic, a beam angle of less than 2° can be achieved. The 7mm SMD package is provided on a star-shaped connection pad with an integrated heat sink; thus, the component can be easily integrated on different circuit boards.

This white light source provides the light for LASER COMPONENTS' ALBALUX® modules. ■

Svante Karlsson: +46 704 548 306
s.karlsson@lasercomponents.se



UVC LEDs from Bolb

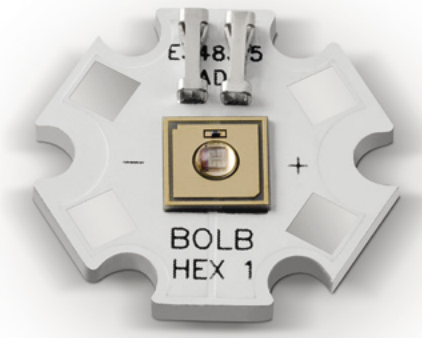
New Methods of Disinfection

WEB N11-042

Bolb, Inc. is our reliable new partner in UVC LEDs. All the products offered by Bolb, a manufacturer based in California, are now available in stock at LASER COMPONENTS throughout Europe. Bolb has specialized in the UVC wavelength range.

The company's flagship product is its germicidal LED (GLED), which provides significantly higher performance than similar products from other manufacturers. In important applications such as water treatment and the prevention of hospital germs, new processes for the treatment of surfaces, water, and air are possible. ■

Harvey Washbrook: +46 708 770 679
h.washbrook@lasercomponents.se



LuxxMaster Is Now NovaTru

Wavelength-Stabilized Laser Sources for Raman Spectroscopy

WEB N11-084

- NOVATRU CHROMA
  Wavelength stabilized
- NOVATRU POWER
  Power stabilized

Svante Karlsson: +46 704 548 306
s.karlsson@lasercomponents.se

ALBALUX® FM
Portable Sun

The brightest fiber-coupled laser white light modules on the market. ■

WEB N11-174

Harvey Washbrook:
+46 708 770 679
h.washbrook@lasercomponents.se

UPCOMING EVENTS

ADVANCED ENGINEERING 2020
Åbymässan, Gothenburg, Sweden
March 25–26
Booth E:15

Scandinavian Electronics Event 2020
Kistamässan, Stockholm, Sweden
May 5–7
Booth 11:44

Optics and Photonics Days OPD2020
Turku University of Applied Sciences, Turku, Finland
May 25–27

LASER COMPONENTS®