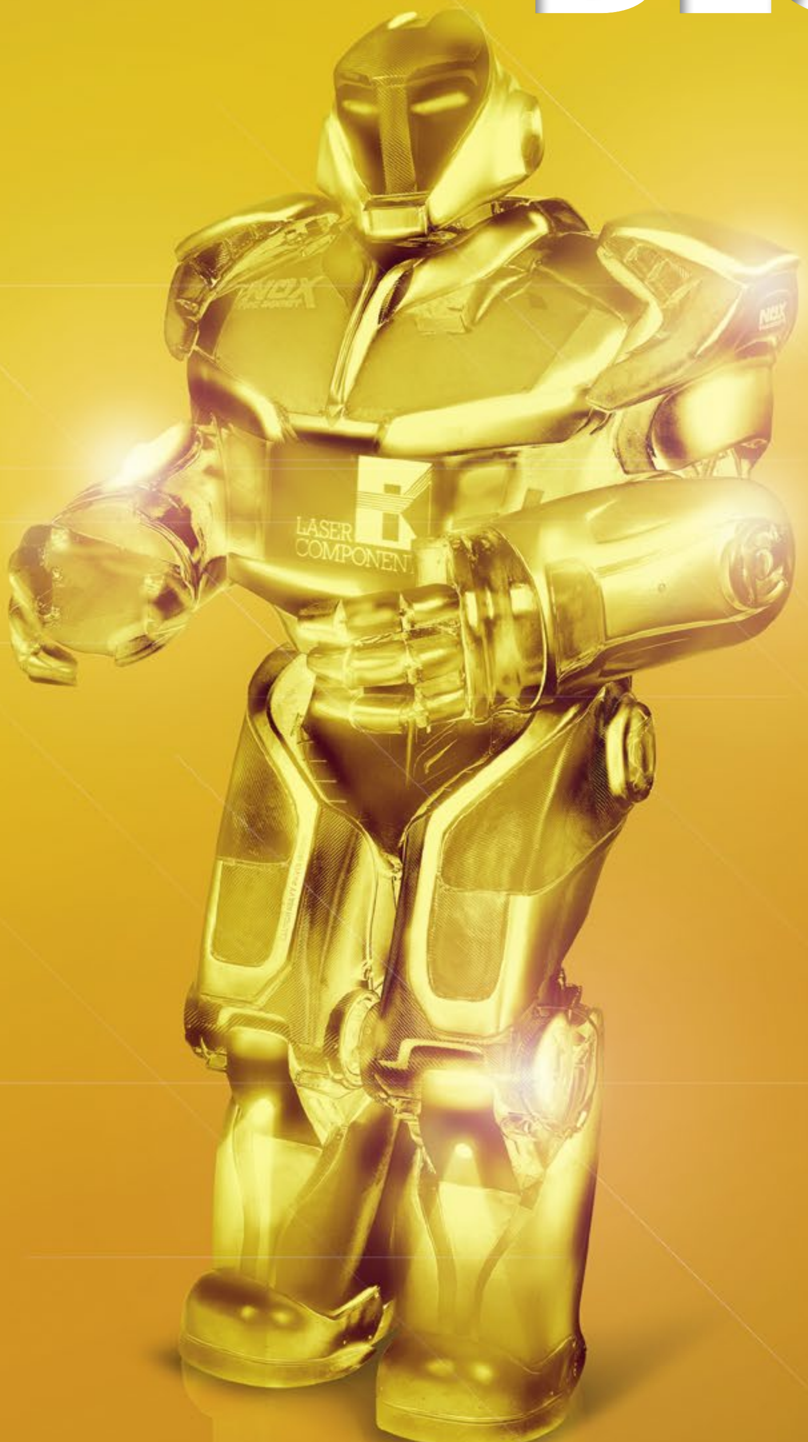
# PHOTONICS NEWS

LASER COMPONENTS USA, Inc. Magazine 02|18 laser-components.com

# 'BEST OF' Edition



IR Polarizers

High-Power Laser Optics

White Laser Light Sources

Positioning/Measuring with Lasers

Fastest Hybrid Pulsed Laser Diodes

# UPCOMING EVENTS

**MD&M West**
Anaheim, CA
February, 6–8, 2018
**Booth 3593**

**The Vision Show**
Boston, MA
April 10–12, 2018
**Booth 410**

**SPIE Defense & Commercial Sensing 2018**
Orlando, FL
April 17–19, 2018
**Booth 1029**

*Content*

## Most Read Articles of 2017



## Product News




Photonics News is published by



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# Cheers to All the Good Things 2018 Will Bring!

The SPIE Photonics West show is that time of the year to reflect on the past year and to look forward to new endeavors.

In 2017 we kicked-off with the introduction of the world's fastest hybrid pulsed laser diode and avalanche photodiode arrays optimized for LiDAR. A technology that will disrupt the automotive and drone market for good. So much so that we dedicated a whole Photonics News edition to security and safety measures, successfully worked through the automotive AEC-Q101 qualification, and continue to develop new products at lower cost for the mass market.

2017 was also the debut of the first IR WORKshop in the US. An initiative welcomed by many of our peer colleagues seeking out smaller-sized workshops with time for networking in a private setting. Building on the success of this event, we will extend the concept and commit to a full-day workshop at the Photonics West Industry Events. Experts from our manufacturing facilities, as well as select suppliers, will hone in on essential working principles of high power laser optics, polarizers, pulsed laser diodes, avalanche photodiode arrays, white laser light, and IR detectors to better design next-generation applications in time-of-flight measurement, photon counting, laser material processing, manufacturing, machine vision, medical, spectroscopy, and gas sensing, … to name a few.

Designing innovative products for the applications of tomorrow, sharing knowledge, and working together is our mantra and sets the path for the years to come. This message is enforced once more with our most recent product extension with SoraaLaser's white laser light source; delivering the highest luminance and intensity concentration.

Do you want to know what else to expect at our booth?
We invite you to take a glimpse at the new products section or stop by to discuss it together with us. We look forward to talking to you about your next endeavor.

Sincerely,

Gary B. Hayes

Gary Hayes
CEO/General Manager, LASER COMPONENTS USA, Inc.

# Distance Measurements Prevent Collisions

## LiDAR Systems for the Recognition of Obstacles

For vehicles to drive autonomously or unmanned aerial vehicles to fly alone, they must be able to recognize obstacles in order to avoid them. Monitoring surroundings using LiDAR systems has many advantages: These systems are not only inexpensive, but they can also measure distances of up to 100 meters. LiDAR is short for **li**ght **d**etection **a**nd **r**anging.

During measurement, pulsed laser diodes (PLDs) are used as emitters and avalanche photodiodes (APDs) as receivers; this measurement principle is based on optical time-of-flight (ToF) measurements.

### Optical ToF Measurements

The principle of optical ToF measurement can be easily explained: A PLD sends a single short light pulse; ideally, this light propagates undisturbed along the shortest path through the air until it detects an obstacle. At the obstacle, light is reflected and the pulse returned to be detected by an APD. The electronics that connect APDs and PLDs measure the time Δt between sending and receiving the returned light pulse. Because the propagation speed of light is already known, the distance l of an obstacle can be easily calculated from measured time.

### Autonomous Driving

The study published by Frost & Sullivan on the "Automotive LiDAR Market for ADAS and Automated Driving, Global 2016" expects the advance of LiDAR technologies in autonomous driving. Application fields range from lane departure warning systems to autopilot functions. Their widespread introduction is expected by the year 2025.

Source: frost.com/mb5c

### Basic Physical Principles

Light propagates in a vacuum at light speed c. Measurements in a vacuum yield the following value for c:

$$c = 299{,}792{,}458 \text{ meters/second}$$

In the physical sense, a vacuum is space without matter; therefore, it has an optical density of n = 1.

The smallest dust particles found in the air change this optical density, which is known as the refractive index n. The wavelength and phase speed are smaller than in a vacuum; therefore, the speed of light propagation also changes: $c_{air} = c/n_{air}$

### Calculation Example

Imagine for a minute that a light pulse is detected at **Δt = 500 ns**. The obstacle has a distance of l, the measured time refers to the two-way (back and forth) path of light (i.e., 2*d).

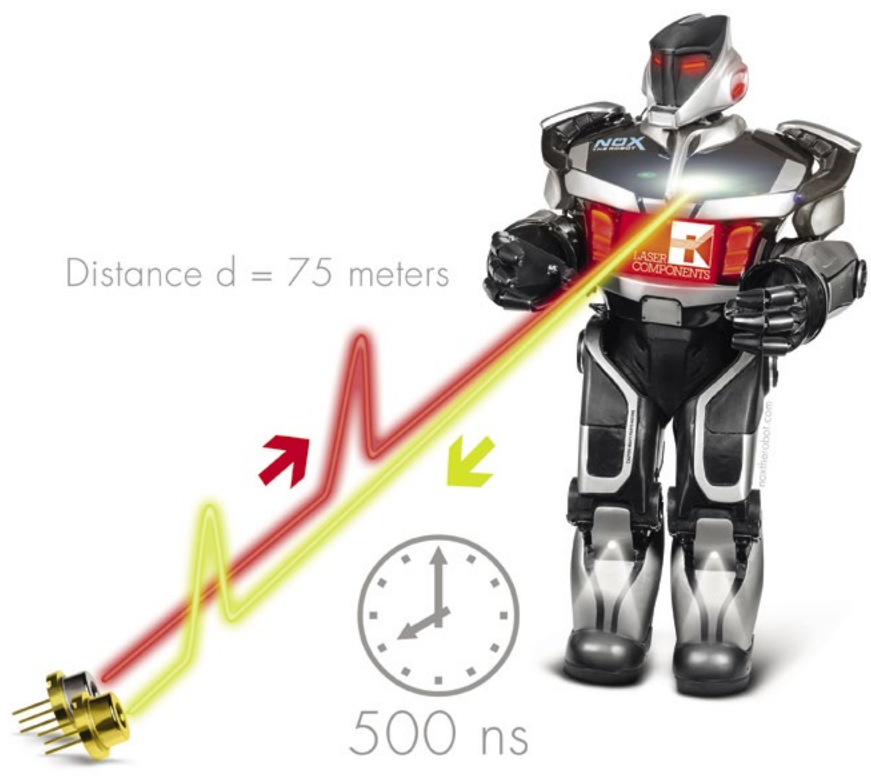
The distance can be measured in your head if you allow for the following approximate values:

$c = 300{,}000{,}000\ m/s = 3*108\ m/s$
$n = 1$

The following equation applies:
$\Delta t = 2*d*n/c = 500\ ns = 5*10^{-7}\ s$
$d = 0.5 * (c * \Delta t) / n$

The distance can be calculated as:
$d = 0.5*\ (3*108\ m/s\ *\ 5*10^{-7}\ s)/1$
$d = 0.5*3*5*10^{1}\ m = 75\ m$

It is impressive to realize just how small the intervals are that are required for measurements at short distances; these intervals extend into the picosecond range, which is the trillionth part of a second. ■



# Quality of Pulsed Laser Diodes Meets Highest Demands

## Qualification for Automotive Industry

LASER COMPONENTS is proud to announce that the first of its products has achieved qualification for use in the automotive industry. Pulsed Laser Diodes (PLD) with a wavelength of 905 nm are key components for the LiDAR technology (Light Detection and Ranging) used in autonomous driving.

In the interests of safety and technological excellence, the automotive industry demands the highest quality standards from their suppliers – including those delivering electronic components.

Manufacturers are required to deliver a detailed Production Parts Approval Process Report documenting and qualifying their entire production line. To qualify, companies must demonstrate compliance to the reliability and environmental standards of the Automotive Electronics Council (AEC). Car companies also push the boundaries when it comes to functionality in extreme surrounding conditions. While other industries take the temperatures inside a manufacturing plant as a reference, car electronics must also prove their reliably in arctic or tropical climates and are therefore tested at a range of temperatures from -40°C to 105°C (-40°F to 221°F).

Similar standards are applied for humidity and mechanical shocks.

"So far, our PLDs have been very successful in laser scanning applications. Thanks to research areas like automotive driving, there is an increasing number of requests from the automotive industry", says Winfried Reeb, Head of Business Unit Active Components at LASER COMPONENTS. "This first successful qualification proves that we are prepared for this promising yet demanding market." ■

## Autonomous Flight - Products for Distance Measurements

It may soon be a requirement that drones be able to measure their distance to obstacles. LASER COMPONENTS offers the components necessary to build inexpensive sensors for this purpose.

### Avalanche Photodiodes

Small and inexpensive: the SAH series avalanche photodiodes are packaged in an SMD housing that has an edge length of just 3.1 mm x 1.8 mm. These components are optimized for the wavelengths 850 nm and 905 nm, have a high quantum efficiency, and operate quickly.

### Inexpensive Pulsed Laser Diodes

The UA series pulsed laser diodes are a good counterpart to the inexpensive APDs, featuring power levels of up to 75 W. They are as inexpensive as comparable PLDs in a plastic housing; however, they are of a higher quality with their ultra-precise mechanical tolerances. The hermetically-sealed metal housing has a diameter of 5.6 mm, providing excellent temperature stability of the component.

### Pulsed Laser Diodes with Short Pulses

We are ready to introduce pulsed laser diodes that are called QuickSwitch®.

This year we will celebrate the introduction of these new components into the market. They are characterized by particularly short pulse widths of just 2.5 ns. A preliminary datasheet is available online under the web code provided. More information will follow over the course of the year. ■

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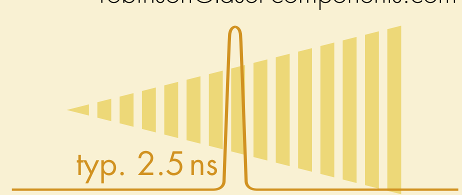


# Eye Surgery Using Excimer and Femtosecond Lasers

## Just a Few Hours After Surgery, Patients Have Enhanced Vision Again.

For the majority of people, vision is natural. Many consider the eye the most important sensory organ. If it does not function the way it should, we find it extremely limiting: it is necessary to find a remedy. The options are phenomenal, and intelligent technologies achieve – to some extent – the unimaginable. It seems almost "normal" to undergo laser eye surgery to eliminate the need to wear glasses. In fact, so-called laser in situ keratomileusis (LASIK) surgery was introduced more than 20 years ago. Excimer lasers have been used since then in operations to correct defective vision.

### Image Formation in the Eyes

Christopher Scheiner (1575–1650) was the first person to explain the correct accommodation ability of the human eye [1] and prove image formation on the backside of the eyeball. This knowledge is the foundation of operative repair of defective vision.

Defined simply: The eye's imaging system consists of the cornea and a lens system composed of the anterior chamber, eye lens, and vitreous body. The corneal system has a larger refractive effect than the lens system [2]. The lens is shapeable in its entirety via the ring muscle. This allows near and far objects to be imaged sharply on the retina – a characteristic that deteriorates with increasing age. For better comprehension, the eye can be displayed as a thin positive lens [3].

### Defective Vision

The most common forms of defective vision that can be corrected with laser surgery include corneal curvature, myopia, and hyperopia. The latter two forms are based on a non-ideal formation of the eyeball, which means that distant objects are imaged before or after the retina.

In nearsightedness, the axial direction of the eye is too long; the focal point of distant objects is in front of the retina. Myopic patients can see well at short distances.
In farsighted patients, the retina is too far forward; however, the ciliary muscle can compensate this defect – in part even up to 2.5 dpt [4].

### Laser Method

In ophthalmology, lasers are used to burn, cut, or remove objects. The goal of treatment in refractive surgery is the ablation of the eye cornea in order to achieve optimal refractive power. Many different methods are available on the market that work with femtosecond lasers and/or excimer lasers. The femto-LASIK method, which was first approved in the U.S.A. in 2001, is particularly popular [5].

### Femto LASIK Method

Two different laser technologies are applied consecutively in this method of treatment. A femtosecond laser cuts the outer layer of the cornea, which is opened up as a flap for subsequent treatment. The excimer laser is then used to correct defective vision in one of the deeper layers of the cornea. The open flap is then closed to allow the wound to self-seal in a final step and reattach in a matter of a few hours [2].

### Know-how

The excimer laser vaporizes the corneal tissue to be removed via photoablation. Myopia up to -10 dpt can be treated by vaporizing a round piece of tissue in the center of the cornea. To correct hyperopia up to approximately +3 dpt, the curvature of the central cornea is intensified and the refractive power of the cornea increased by ablating the edge of the cornea [6]. Quick ablation is advantageous.

In high-end systems, the 193 nm excimer lasers achieve repetition rates of 1050 Hz: thus, the duration of ablation decreases to 1.3 seconds per diopter [7].
The eye can move even in this short period of time; thus, the quality of eye tracking during treatment can have a significant effect on the outcome. ■

## Laser Modules in Ophthalmology

Before the excimer laser can be used in refractive surgery, the entire system must be individually adjusted to the patient.
Laser modules provide support in very different tasks:

cross-hair lasers aid, for example, in the positioning of patients along the x and y axes. Also, the working height is determined via a laser module. Prior to actual surgery, the patient fixates the blinking light of the dot laser. Similar to laser material processing, a pilot laser displays the working point of the invisible laser radiation of the excimer laser.

All auxiliary lasers radiate directly into the human eye; therefore, in order to prevent damage to the eye, the laser modules used must guarantee the following:

- Multiple safety measures: The output power is a preset value that must be guaranteed and may never be exceeded. The sum of the output of all of the auxiliary laser modules may not exceed the restrictions of laser class 1.
- Power setting: The setting of very low output power in the µW range must be possible.
- Traceability: All components must be traceable without any gaps.
- Outgoing goods inspection: A complete outgoing goods inspection of all components must be ensured.

At LASER COMPONENTS, we fulfill all requirements and offer FLEXPOINT laser modules from our sales office in the USA. These modules can be customized. We are equipped to meet the requirements of medical technology with our quality management system certified according to ISO 13485. ■

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[2] Prof. Dr. med. Thomas Kohnen, Deutsches Ärzteblatt, 29. Feb. 2008
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[3] Pedrotti, Pedrotti, Bausch, Schmidt, Optik - Eine Einführung, Prentice Hall, 1996
[Pedrotti, Pedrotti, Bausch, Schmidt, Optics - An Introduction, Prentice Hall, 1996]
[4] http://www.auge-online.de/Therapie/Operation_von_Sehfehlern/operation_von_sehfehlern.html
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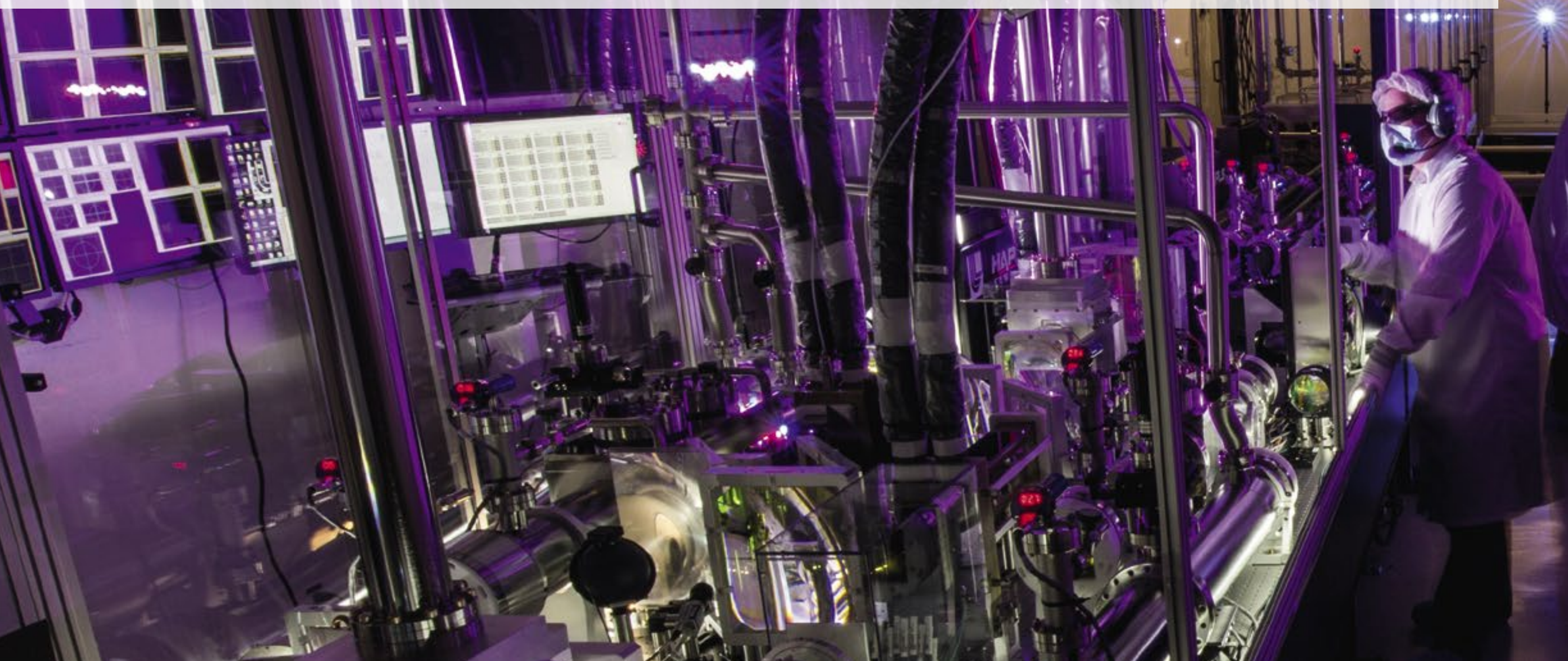
[7] Performance, die bewegt, Die SCHWIND AMARIS® Produktfamilie, Schwind eye-tech-solutions, 2013
[Performance that moves, The SCHWIND AMARIS® product family, Schwind eye-tech-solutions, 2013]

# Laser Optics for the Highest Possible Energy Densities

Everybody is familiar with the scene in Goldfinger in which the antagonist attempts to slice James Bond 007 in half with a laser beam. In 1964, this film was pure science fiction. Just one year earlier, the first CW laser had been developed – at a power level of approximately 1 mW. This is not even strong enough to cut through a sheet of paper.
Lasers in the kW range are now a part of everyday industrial life and would not fascinate people anymore at the movie theater. For research purposes, the first devices are in use with several hundred terawatts. However, neither welding lasers nor fusion reactors can function properly without proper optics. At high power levels and energy densities, the expectations are high.



## Setting Standards in Committees and Research Projects

### Our Clients Can be Sure to Get the Latest Technology

"We use state-of-the-art plasma-assisted coating methods, actively participate in research projects, and set standards by partaking in the DIN Standards Committee."

Our activities are diverse. We make sure to use state-of-the-art coating methods and produce dielectric coatings with high laser damage thresholds for high-power lasers.

We create custom designs using modern software tools that derives the layer sequence and then transfers it directly to the coater.

In addition to the electron beam method, we also use plasma-assisted methods that are characterized by low drift: This includes both ion beam sputtering (IBS) and plasma ion assisted deposition (PIAD). We are not only well equipped with coating chambers, with which we are able to implement all standard methods, but measurement technology is one of our strengths as well.

This makes it possible for us to ensure process safety: the coaters are fully automated and computer assisted, and the layer composition is monitored online during the coating process.

PLUTO+ (FKZ13N13208). As part of PLUTO+, we check layer systems for 2.1 μm and 2.9 μm. We focus on the examination of plasma and its effect on coated substrates. This results in process-relevant plasma parameters.

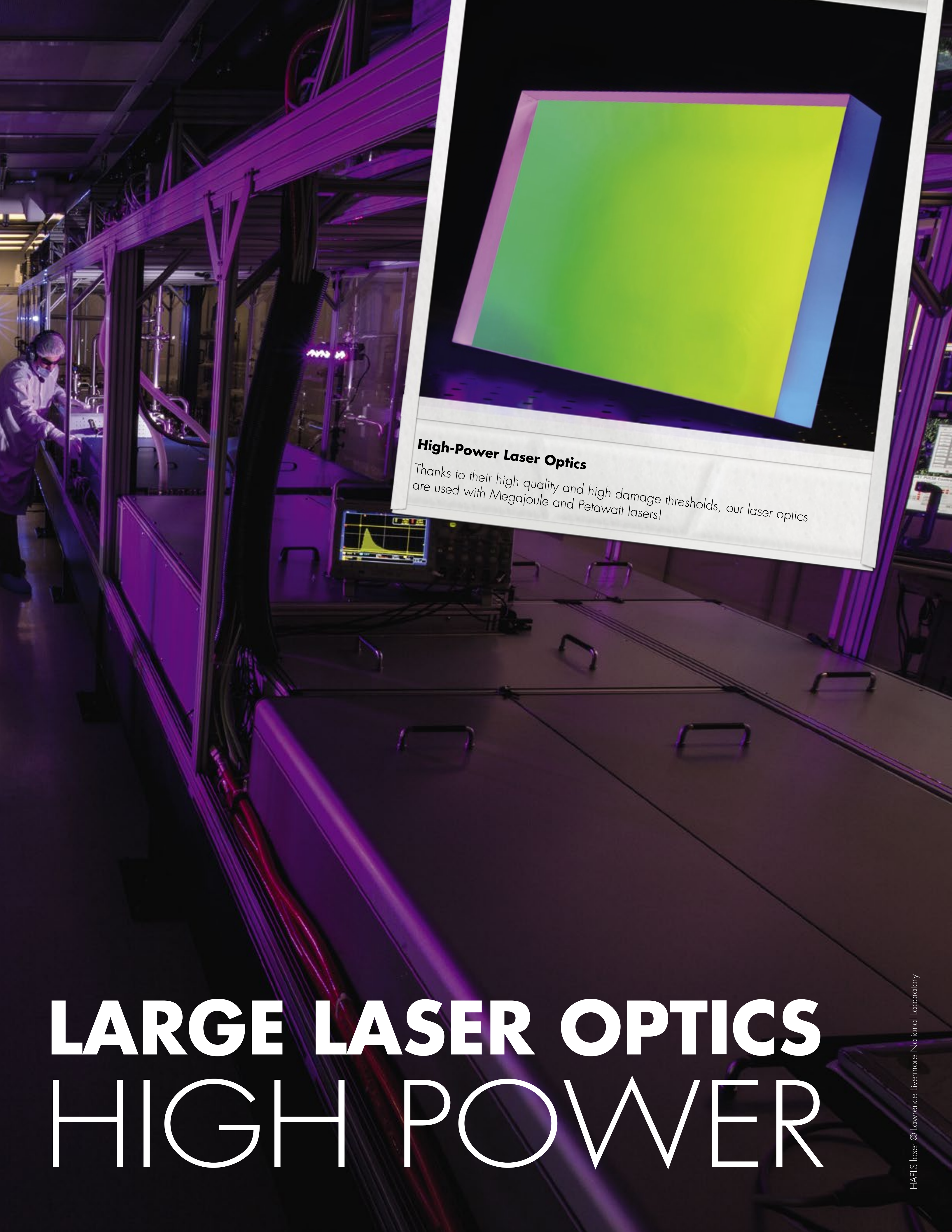
Together with our partners, we are currently working on new process diagnostics and are testing innovative standard concepts for industrial coating processes.

Nano-RuGIT (FKZ KF2638302NT4). We are responsible for the design of next-generation pulse compression gratings, as well as the development, production, and measurement of coatings with a high laser damage threshold. We take new approaches to the designs created for PIAD and IBS. Together with our cooperation partners, we structure layer systems and test them with respect to their effect on short-pulse lasers.

DIN Standards Committee
Furthermore, our technical director, Dr. Lars Mechold, is a member of the DIN Standards Committee on precision mechanics and optics NA 027-01-18 AA. DIN is responsible for establishing and revising standards, for example, for the measurement of damage thresholds.

**High-Power Laser Optics**

Thanks to their high quality and high damage thresholds, our laser optics are used with Megajoule and Petawatt lasers!



# LARGE LASER OPTICS
# HIGH POWER

# Driving Under the Influence: Determining the Breath Alcohol Level

## Breathalyzers Combined with Vehicle Immobilizers

"Driving under the influence" and vehicle immobilization are hot topics of discussion. Measurement apparatuses in automobiles are designed to lock the ignition when the driver's alcohol content is too high. It is not until the driver is able to blow an acceptable level into the alcohol ignition interlock breathalyzer that the motor can be started.

As of 2012, all states have adopted some sort of ignition-interlock laws as a sentence alternative for drunken drivers. Some states, and in Canada some provinces, even require installing an Ignition-Interlock Device (IID) for all offenders. Repeat offenses have been reduced by 70% while they are installed, but despite these laws, only about one-fifth of those arrested install the interlock.

### Ignition Interlock Retrofitting

There are a growing number of people who want to voluntarily install an interlock device in their car. The reasons are manifold and range from protecting young drivers, to making sure that employees don't drink on the job. "Alcoguard" ignition locks can be ordered with Volvo as a special option, but also other technologies are making their way. The measurements are based either on breath alcohol content or alcohol levels directly under the skin.

### "Breathe!"

### Breathalyzer as Opposed to Blood Sample

In the United States, the legal limit for driving is set at 0.08% Blood Alcohol Concentration (BAC) for those over the age of 21. There are three types for testing BAC, but the most common is breath testing. In some states, you are allowed to request a blood or urine test.

Alcohol consumption can be detected in the blood, as reabsorbed ethanol enters the bloodstream through the oral mucous membrane, the stomach, and especially the small intestine. In the lung alveoli, there is an exchange of gas between ➔

the alcohol from the arterial bloodstream and the air breathed. Therefore, alcohol consumption can be determined via breath gas analysis. It is even possible to determine the concentration of alcohol because there is a physiological correlation between the breath alcohol content (BrAC) and the blood alcohol content (BAC) (Henry's law: average partitioning factor of 1:2100). In order to convert the result of the breath alcohol measurement to a blood alcohol concentration, a blood/breath ratio must be used. There is a lot of dispute on this subject and different countries have each adopted their own assumed value of this ratio, with 2,100:1 being used in the U.S.A. Thus, the following applies: 0.08% BAC = 0.073 g/210l BrAC.

### How Breath Alcohol Content is Measured…

There are three major measurement devices based on: an electrochemical sensor, an infrared sensor, or alcosensor. We will discuss the first two:

### Electrochemical Sensor

In the electrochemical detection of alcohol, the current produced in the chemical conversion of ethanol is measured.

An electrolyte and at least two opposing electrodes are located in a measuring chamber; these electrodes are connected to an ammeter. A defined air volume is blown into the measurement cell. If ethanol can be detected, a measurable current is produced via a redox reaction. One reaction partner is oxidized (i.e., it releases electrons) and the other is reduced (i.e. it absorbs electrons). The current flow produced in the chemical reaction is equal to the alcohol concentration.

One problem with electrochemical sensors is the measurement accuracy, which is reduced with increasing operating hours.

### IR Sensor

The easiest method is to use so-called non-dispersive infrared (NDIR) sensors to detect gases. In this method, a measurement cell is irradiated with infrared light, which is collected on the opposite side by a detector. Narrow bandpass filters (interference filters) are mounted in front of the detector.

Gases have characteristic absorption lines that make clear identification possible with the help of absorption spectroscopy. Even the gas concentration can be determined. The Lambert-Beer law, which describes the correlation between a reduction in the beam intensity and the concentration, applies here. This system exhibits long-term stability. ■



# New Products

## QuickSwitch PLD

### Fastest Hybrid Pulsed Laser Diode

The QuickSwitch PLD is a unique 905 nm laser diode that produces a typical 2.5 ns pulse at 80 watts in a TO56-package. A high current switch, charge storage capacitor and pulsed laser diode are all embedded in a small hermetic package which provides EMI shielding when the switch is active.

The high peak power laser with short pulse width and high frequency enables more precise distance measurement in LiDAR and other Time-of-Flight applications. With high kHz pulse frequencies, the device is also ideal for scanning.

With an unbeatable performance at an affordable cost, QuickSwitch is geared towards autonomous vehicles, drones, robotics, safety&security scanning, and 3D mapping. ■

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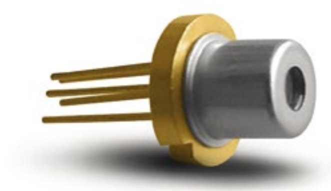

## Square Fiber Pulsed Laser Diodes

### High-Power and Uniform Laser Output

The SQF PLD is a powerful, multi-junction pulsed laser diode connected to a special fiber structure. This particular design allows a homogeneous beam profile to be achieved after just a few centimeters. The advantage of this assembly is that it is compact and robust and simultaneously exhibits low losses and thus a higher peak power.

This makes it a viable alternative to large and expensive laser systems. Depending on the laser diode chip and fiber core diameter, peak power levels of 25 W out of the fiber can be reached. Custom versions are available. ■

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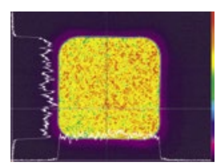

## Si APD Arrays

### Customized Configurations to Meet Application-Specific Requirements

LASER COMPONENTS offers customized Si APD arrays with high sensitivity and low crosstalk, optimized for the 800–900 nm wavelength range. The arrays can readily be configured at variable dimensions from 4 to 16 elements.

Higher pixel count and multi-row configurations are possible as well. Additional options include integrated electronics and bandpass filter. ■

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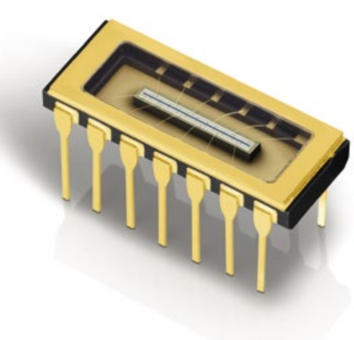

# Next-Generation Si APDs

## Conquering Low-Cost Applications

LASER COMPONENTS has designed a new SAH APD with increased performance and at the same time reduced cost. The new APD structure allows for an optimized production process with higher throughput resulting in a lower cost per device. Key features include high speed and a gradual multiplication curve.

The compact SMD package measures only 1.4 x 2.0 mm with an optical filter that can be deposited directly onto the APD.

This set of features makes the SAH APD ideal for ToF Laser Rangefinder and LiDAR applications. ■

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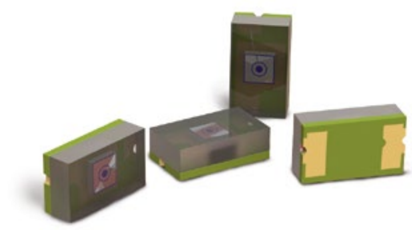

# Expansion of DOEs for Laser Modules

## New Pattern Generators Available for Green Lasers

Diffractive Optical Elements (DOEs) are ideally optimized for a specific wavelength.

Because the green 520 nm wavelength is becoming more and more popular, we have expanded our product range with a number of new DOEs for green light, including a cross hair that has a fan angle of more than 50°, and a DOE with 15 parallel lines. ■

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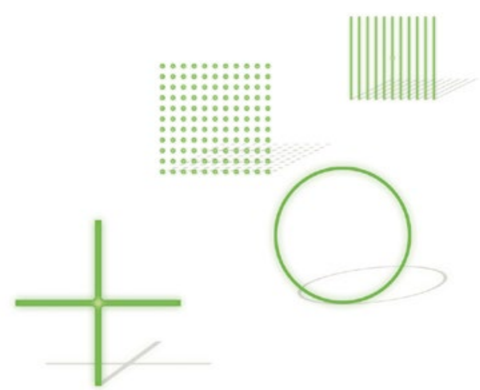

# New Laser Modules for Industrial Image Processing

## FLEXPOINT MV: Positioning and Measuring with Lasers

We are introducing the completely revised versions of the successful line laser series: MVfemto, MVpico, and MVnano.

New features include:

- **New focus mechanism:** results in a higher beam pointing stability and a low drift in the line position.
- **New optics options:** a variety of optics are available to obtain a suitable combination of line thickness and depth of focus: DLSE, DLE, DL, Standard, TS1, and TS2.
- **$Cos^4$ - correction:** leads to a homogeneous power distribution on the camera chip.
- **Housing flexibility:** compact standard units, electronics separated from the optical head, or laser diodes and optics only. ■

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# IR Laser Diodes for Use in Gesture Recognition

## 250 mW Single-mode Laser Diodes

Applications in medical technology, printing, and safety technology (IR illumination) require powerful laser diodes that have a longitudinal single-mode beam profile.

The laser diode ADL-83Y51TL is a very good and inexpensive laser diode that emits in the NIR range at 830 nm and has a cw power of 250 mW. In pulse operation, it can be overdriven to up to 500 mW.

The small, compact TO-56 housing is hermetically sealed and allows for an operational temperature of up to 60°C. A monitor photodiode is integrated for power control and stabilization purposes. ■

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*New Products*

# White Laser Light Sources Emerge

## Winner in Luminance and Long Range

Prism
Awards
Finalist

SoraaLaser's LaserLight, a visible laser-diode-pumped phosphor light offering unique performance properties in low divergence and waveguide delivery, is the latest add-on to the LASER COMPONENTS product line for biomedical, industrial materials processing, and specialty illumination applications.

Based on patented semipolar GaN laser diodes, the sources also use advanced phosphor technology, providing minimal power consumption and a long lifetime with highly directional output resulting in many advantages over LED and HID light sources.

LaserLight will come as a miniature SMD (Surface Mount Device) or fiber-coupled module emitting up to 500 lumens. The LaserLight Fiber allows system integrators to embed the laser diode source, drive electronics and heatsink, and utilize passive fiber delivery to a remote, compact, lightweight white light illumination source. ■

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# Collimated Homogenizer Module

## Diffractive Optical Elements for High Power Lasers

The Collimated Homogenizer Module is Holo/Or's customer-specific solution for applications requiring a wide range of working distances. With a Collimated Homogenizer Module, the uniform-intensity beam is maintained with high reliability, power uniformity, and constant size/shape over an extended working distance range up to 300 mm.

Popular applications include aesthetic skin treatments, laser welding of polymers, and laser surface treatments such as cleaning, hardening, de-coating, color ablation, ... ■

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# New IR Polarizers

## The Right Choice for Optical Devices

CODIXX is announcing new colorPol N-series, made for the popular laser wavelengths of 1310 nm, 1490 nm and 1550 nm. The colorPol IR 1310N BC4 HT, the colorPol IR 1490N BC4 HT and the colorPol IR 1550N BC4 are optimized for one wavelength and the surrounding 30 nm. This new N-series offers exceptional properties.

CODIXX polarizers are characterized by high contrast, high transmission, and broad spectral bandwidth. Dimensions and other specifications are possible according to customer requirements. ■

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# Specialized in Ultra-Short-Pulse Laser Optics

## Proven High Laser-induced Damage Thresholds

Our standard high power coatings for laser mirrors are produced through physical vapor deposition (PVD) using an electron beam evaporation source, also called an e-beam. Using this technology, we are able to produce large substrates at competitive prices in-house and offer the optics up to 300 x 200 mm with very high homogeneity over the complete dimension.

The flatness after coating has been demonstrated with very good quality reaching up to λ/10 at 633 nm over clear aperture. ■

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# Superior Thermoelectric Coolers for PbSe/PbS Detectors

## Leveraging Mid-IR Detection

Enhanced PbSe/PbS detector performance can be achieved by both cooling and temperature stabilization. The latest available Thermoelectric Coolers (TECs) provide that control with greater efficiency at lower operating power levels. Cooling PbSe/PbS detectors increases sensitivity and extends the peak wavelength response. These improved heat pumps achieve the same ΔT with less required cooler power.

Better feedback control of the TEC top stage maintains detector temperature stability. Combined with proper heat sink design and identifying the optimum operating temperature, these superior TECs help to provide the best possible detection in the mid-IR. ■

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# Pyroelectric Detectors with Differential Amplifiers

## Increased Signal-to-Noise Ratio

Pyroelectric crystals generate positive and negative charge carriers simultaneously on opposing sides. The LD2100 series is the first series in which both crystal sides are amplified separately: the useful signals add up linearly, which means that they are doubled. The noise portions only add up statistically; altogether there is a net gain in the signal-to-noise ratio! ■

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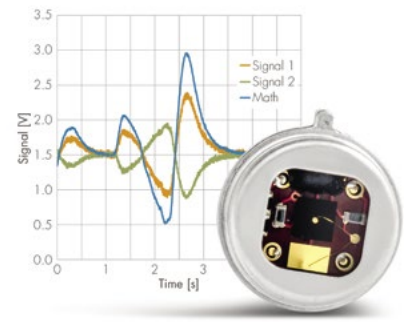


# OEM Electronics for x-InGaAs Line Arrays

## TEESS: Electronics and Software Support Complex Operation

Line arrays are complex components that require precise control. We offer our customers a modular test kit that consists of a sensor board, a central unit in a metal housing, a heat sink socket for the array, a set of cables, and convenient software. The sensor board takes care of correct addressing, converts the analog output signal of the x-InGaAs line sensors into a digital signal, and communicates with the central unit. ■

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# Xlin-FC InGaAs Line Arrays

**Prism Awards Finalist**

## Advances in Low-Noise and High-Speed Performance up to 400 kHz

Xenics newly developed Xlin-FC series is a set of InGaAs line arrays featuring low noise and – at the same time - a world-record 400 kHz line rate at 512, 1024 or 2048-pixel resolution. The detector uses flip-chip (FC) hybridization and operates in low illumination conditions thanks to highly sensitive Read-Out Integrated Circuit (ROIC). 5 gain settings allow the user to benefit from optimum performance either in high dynamic range mode, or high sensitivity mode.

The Xlin-FC has been selected as one of the finalists of the SPIE / Photonics Media Prism Awards. ■

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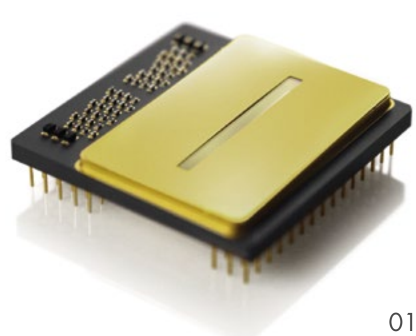


Free Workshops at the Industry Events

# SPIE. PHOTONICS WEST

Wednesday, January 31, 2018
Moscone West (Room 2018, Level 2)

## OPTICS

### How to Specify High-power Laser Optics and Polarizers

Specifying the correct optical component may determine the success of an application. This session focuses on high-power laser optics and polarizers, their functional principles, essential properties, and corresponding effects depending on the application. ■

Instructors from:
CODIXX and LASER COMPONENTS

Part I 8:30–10:00 am

## LASERS

### From Pulsed Lasers in LiDAR to White Laser Light

The first workshop will zoom in on driving FET-based Pulsed Laser Hybrid Circuits and Silicon APD array structure and operation. To close this session, we will provide an overview of a next generation white laser light module that produces high luminance, incoherent, broad spectrum white light. ■

Instructors from:
SoraaLaser and LASER COMPONENTS

Part II 11:00 am–1:30 pm

## DETECTORS

### What are the Best New IR Technologies

This session will provide an overview of the different types of IR detectors available on the market today & cover their usage in industrial gas sensing applications, spectroscopy, radiation thermography and non-destructive inspection processes. ■

Instructors from:
Xenics and LASER COMPONENTS

Part III 1:30–5:00 pm

## Instructors

Barbara Herdt
*Laser Components GmbH*

André Volke
*CODIXX*

Dragan Grubisic
*Laser Components Detector Group*

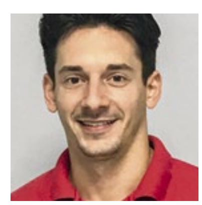
Ran Zhu
*Laser Components Canada*

Julian Carey
*SoraaLaser*

Elliott Martyn Chick
*Laser Components GmbH*

Patrick Merken
*Xenics*

Lowell Snyder
*Laser Components Detector Group*



Justin Jensen
*Laser Components Pyro Group*

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