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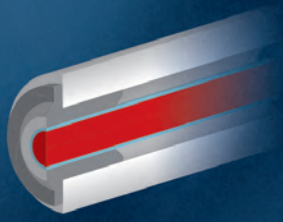

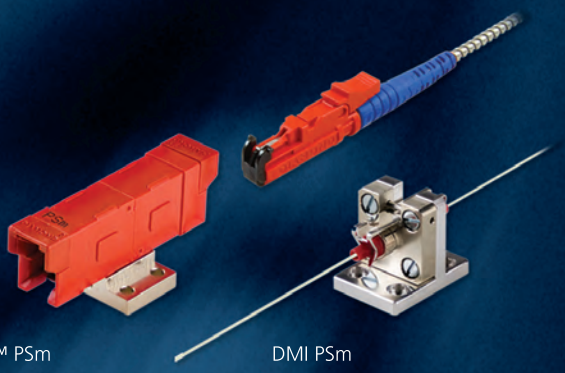

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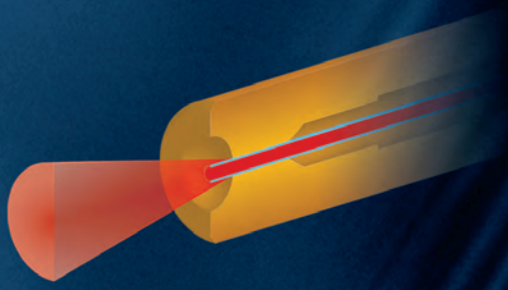

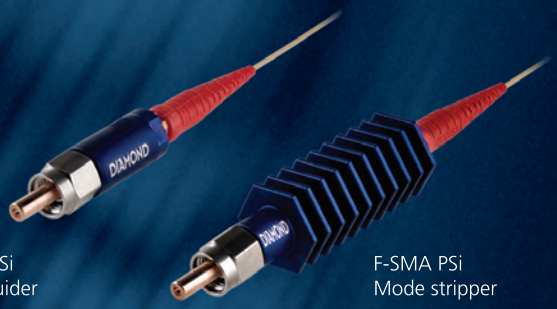

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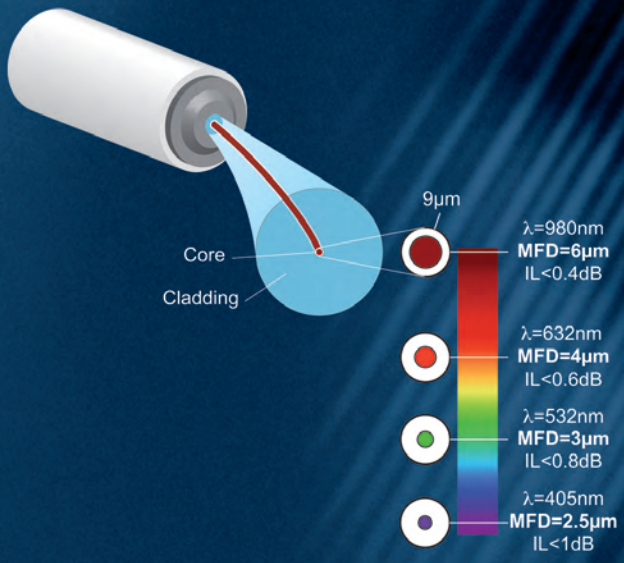

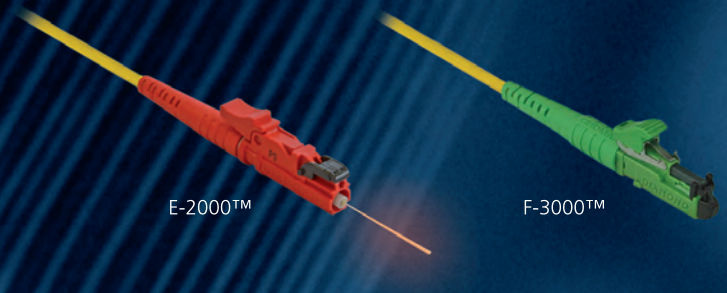

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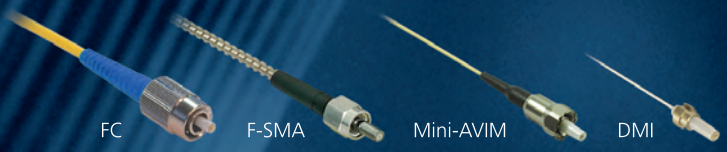

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AIM Photonics at 'inflection point' as latest grant is approved

$81M tranche released for construction and tool installation at test and packaging facility in Rochester. *By Mike Hatcher*

Tool installation and staffing of the AIM Photonics test, assembly and packaging (TAP) facility in Rochester, New York, is set to begin in earnest – after state officials approved an $81 million grant to support operations at the former Kodak site.

Now owned by the Phoenix-headquartered image sensor manufacturer ON Semiconductor, the building at the Eastman Business Park is regarded as a cornerstone of the wider AIM Photonics effort, where state-of-the-art photonic integrated circuits (PICs) will be produced in volume.

Photo: Cuomo Flickr stream.

Now owned by US electronic chip and image sensor maker ON Semiconductor, this building at the Eastman Business Park in Rochester is set to become the central manufacturing hub of the AIM Photonics effort. Capital equipment purchases and operating costs at the test, assembly and packaging (TAP) facility are both being supported with an $81 million grant just approved by New York State representatives.

New jobs for old

New York State governor Andrew Cuomo said that the latest tranche of investment would create new photonics-related jobs in the region, a sentiment echoed by several local representatives.

"By attracting new investment in this burgeoning industry and convening leading photonics leaders [sic] from across the country, this federally designated AIM Photonics facility will accelerate the growth of Rochester and across the region," Cuomo said in a state release.

The $81 million grant will be used to support capital purchases of key tools and equipment, as well as the running costs of the TAP site.

According to AIM Photonics, the tooling portion will include the industry's "first and only" open-access test facility for photonics devices produced on 300 mm diameter semiconductor wafers.

The latest tranche of cash is part of a $250 million commitment from the state to support AIM Photonics, with additional funding in the form of a $110 million award from the US Department of Defense and $250 million in private support for a total investment of more than $600 million.

It comes after an initial $78 million for tooling, equipment, technology licenses and operations, approved in July 2016, and a further $28 million to renovate, equip and operate the TAP facility announced in January.

Milestone

Bob Duffy, who chairs the AIM Photonics leadership council, described the latest release of funds as a "significant milestone," adding: "We are now ready to begin the much-anticipated phase of tooling and staffing the TAP facility. This is truly a great day for Rochester, current and future AIM Photonics members, and all of the stakeholders who have helped to make this possible from the beginning."

Howard Zemsky, CEO of Empire State Development, added: "Rochester's photonics cluster is a fast-growing sector in which the state is making strategic investments that are spurring new growth in manufacturing and building on the region's legacy of being home to cutting-edge optical and photonics technologies."

AIM Photonics video - TAP facilities in Rochester.

Other recent developments at AIM Photonics include a patent licensing agreement with IBM, with the computing and chip giant now a member of the consortium, while a "proposers meeting" for 2018 funding took place in Rochester last week.

According to the organizers, more than 100 members and partners participated in various working groups, with a special session on photonic integrated circuit (PIC) design for AIM's multi-project wafers (MPW) approach to manufacturing.

Industry participants included Cadence, Synopsys, Mentor Graphics, Mosis, Analog Photonics, Lumerical, and PhoeniX Software. "This meeting helped guide individuals interested in submitting a proposal, while learning more about how to engage with the consortium to maximize business capabilities, as well as to learn about the benefits of becoming an AIM Photonics partner," AIM said.

AIM Photonics chairman Tom Koch said that the meeting and the third call for proposals represented an "inflection point" in the evolution of the effort, and pointed out that five new "Tier 1" members have signed up to AIM Photonics so far this year. The closing date for the latest call for proposals is June 19.

http://optics.org/news/8/5/53

The first Orbital Launch

The first successful orbital launch was of the Soviet unmanned Sputnik 1 on October 4, 1957. The satellite is believed to have orbited Earth at a height of about 250 km (160 mi).

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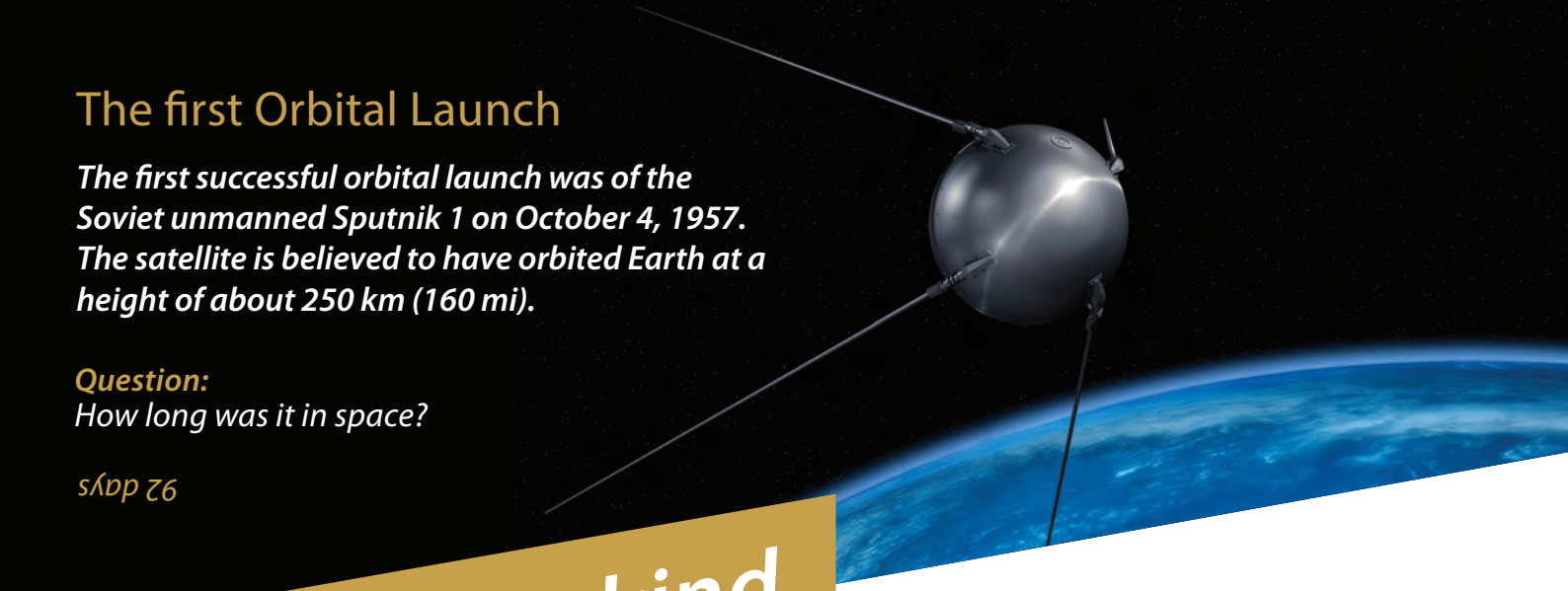

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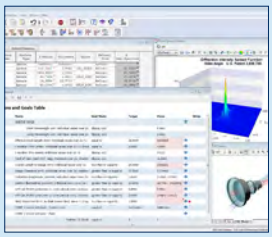

Contact Details
Synopsys, Optical Solutions Group
199 S. Los Robles Avenue
Suite 400
Pasadena, CA 91101
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Contact Details
NKT Photonics
Blokken 84
3460 Birkeroed
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https://navitar.com/products/imaging-optics/resolv4k-zoom-system/

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NASA ditches Earth observation missions amid 'troubling' US science budget

Trump proposals slammed but space agency and others remain committed to some key optics-related developments, including LIGO and telescopes. *By Mike Hatcher*

NASA is to pull funding for several Earth observation missions that were due to carry optics and photonics equipment, but remains committed to many other high-profile projects – including the James Webb Space Telescope (JWST), the Wide-Field Infrared Survey Telescope (WFIRST), and direct exoplanet imaging.

Robert Lightfoot, the space agency's acting administrator, said that he was pleased with a top-line budget figure of $19.1 billion for fiscal year 2018, representing only a slight decrease in NASA's current spend, but admitted that some tough decisions would be needed.

"The hard choices are still there. We can't do everything, but we can certainly do a lot," he said, as several other federal agencies detailed much larger cuts to science spending envisaged in the Trump administration's proposals.

Support for laser comms

In his "state of NASA" report, Lightfoot confirmed that several Earth observation missions would be ditched. They include the Orbiting Carbon Observatory-3 (OCO-3), Plankton, Aerosol, Cloud, ocean Ecosystem (PACE), Climate Absolute Radiance and Refractivity Observatory Pathfinder (CLARREO PF), and the Radiation Budget Instrument (RBI).

Optics-related equipment that had been due to fly on those missions includes three high-resolution grating spectrometers on OCO-3 that would have collected space-based measurements of atmospheric carbon dioxide gas for climate studies. It was due to launch in 2018.

Kit on board CLARREO PF – another mission dedicated to climate studies – was to have included an infrared spectrometer and a reflected solar imaging spectrometer, and would have acted as a "NIST in space", providing reference standards for other sensors in orbit.

PACE was to have used an industry-built multi-angle polarimeter to characterize aerosols – airborne particles that are central to cloud formation and another key

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NASA ditches Earth observation missions amid 'troubling' US science budget

element of climate science and modelling studies.

On the other hand, Lightfoot confirmed plans to launch JWST - currently being prepared for cryogenic testing - next year, along with the future WFIRST mission, and the Transiting Exoplanet Survey Satellite (TESS).

In terms of space technology development, Lightfoot added: "The budget supports our diverse portfolio, which is creating a technology pipeline to solve the most difficult challenges in space - from solar electric propulsion to laser communications and cross cutting technologies that benefit our work across the board."

NASA also announced that it would support "novel partnership opportunities" with commercial partners focused on small satellites (including CubeSats) to work on high-priority science goals, and – more specifically – the development of adaptive optics technology to detect exoplanets, look for signs of past or present life on Mars and other planetary bodies, and to "take the pulse of our planet."

Science budget 'troubling'

Lightfoot's remarks came in response to the Trump administration's overall budget proposal, which confirmed widespread expectations of a sharp decline in science and technology development funding: in that context, NASA appears to have escaped relatively unscathed.

Reacting to the wider budget, described as "dead on arrival" by some and potentially subject to major changes as it passes through Congress, optics.org publisher SPIE described the proposed cuts as "troubling".

At just over $6.6 billion, the fiscal 2018 budget for the National Science Foundation (NSF) would be 11 per cent below the fiscal 2016 level, and support 8000 new research grants – down from the current 8800.

"At first glance this is a very troubling proposal, which calls for historic cuts to US research and development funding," said

SPIE's CEO Eugene Arthurs. "For science and technology, it seems a turning away from investing in the future, from what has brought prosperity and health to our nation and to the world. The final say is with Congress, which we hope will have a different view of the path to a better future."

The Optical Society (OSA) also weighed in, with its CEO Liz Rogan saying: "The proposed budget will cut critical investments in research and development at a number of science-related government agencies, including the National Institute[s] of Health, the National Science Foundation and the Department of Energy's Office of Science.

"Reduced federal funding to these and other agencies will impact optics and photonics enabled innovation and hinder US competitiveness in [the] global marketplace."

Looking on the bright side, NSF director France Córdova confirmed that construction of the Daniel K. Inouye Solar Telescope (DKIST), set to become the world's largest solar telescope, would continue, alongside ongoing support for the Large Synoptic Survey Telescope in Chile.

In addition, the Laser Interferometer Gravitational Wave Observatory (LIGO), described by Córdova as NSF's largest ever investment, will continue to receive backing. "We will continue commissioning planned upgrades to the laser interferometer systems for the LIGO experiment, which discovered gravitational waves in 2015," she said. "These upgrades will allow improved sensitivity to cosmic phenomena at vast distances from Earth."

BRAIN initiative protected; DOE research slashed

Among other major administrative funders of optics-related technology development and applications, the National Institutes of Health (NIH) – key to high-profile projects like the Cancer Moonshot and the BRAIN initiative – could have its overall budget slashed by more than one-fifth.

At $26.9 billion, the 2018 request is $7.7 billion below the fiscal 2017 total, with Science magazine reporting that the Trump budget envisages significant savings by cutting the overhead payments currently made to universities, on top of basic research grants.

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NASA ditches Earth observation missions amid 'troubling' US science budget

However, the budget proposal does at least protect planned support for the Cancer Moonshot and BRAIN initiative, and those projects should receive close to $500 million in 2018 funding, via a separate stream to the main NIH budget.

Also set to suffer major cuts is the Department of Energy's Office of Science. At just under $4.5 billion, it would be down 17 per cent if enacted, and at its lowest level – in terms of absolute dollars, unadjusted for inflation – in a decade.

Those cuts appear to be heavily skewed towards environmental and biological work, which are braced for funding squeezes in excess of 40 per cent. The "ARPA-E" program, the energy equivalent of the defense department's DARPA efforts, also appears earmarked for closure.

The DOE's basic energy sciences program – which supports user facilities including synchrotrons – would also take a significant hit, with Science reporting that two of five nanoscience centers at the office's ten national labs would close and that the Stanford Synchrotron-Radiation Lightsource would be mothballed after three months.

The National Oceanic and Atmospheric Administration (NOAA) is also looking at a dramatic cut in research spending, with the budget for its Office of Oceanic and Atmospheric Research (OAR), dropping from $514 million to $400 million under the proposal.

Reaction: Congress should oppose 'devastating' cuts

Overall, the White House regime is calling for what amounts to a 13 per cent cut in federal spending on basic research, equivalent to a decrease of $4.3 billion.

Among several organizations to slam the proposed spending plan – aside from optics-focused SPIE and OSA – was the American Association for the Advancement of Science (AAAS). Its CEO Russ Holt said that the double-digit cuts would "devastate America's science and technology enterprise."

The Washington, DC, based Science Coalition added: "The extreme funding cuts to science agencies and related programs included in the budget released today would harm America's research enterprise and our nation's leadership in scientific discovery."

The American Physical Society (APS) joined the criticism, urging Congress to reject the proposed cuts and saying that they would "jeopardize the country's standing as a global leader."

"The president made his proposal, but it's up to Congress to determine the budget," said APS president Laura Greene. Referring to Congress' prior rejection of Trump's proposals for the fiscal 2017 budget, she added: "Congress has already shown that it recognizes the crucial role that science plays in US competitiveness."

SPIE's government affairs director Jennifer Douris echoed those thoughts, noting that final decisions on funding levels for fiscal year 2018 would ultimately be decided by Congress.

She pointed out: "Along that line, in the recently finalized fiscal year 2017 omnibus spending bill, Congress provided for an increase in federal R&D by five percent above fiscal year 2016 levels – despite a request for significant cuts by the Administration."

http://optics.org/news/8/5/47

Strathclyde acquires one of the world's most powerful lasers

350TW pulsed laser from Thales will drive seven beam lines to research cancer treatments and particles.

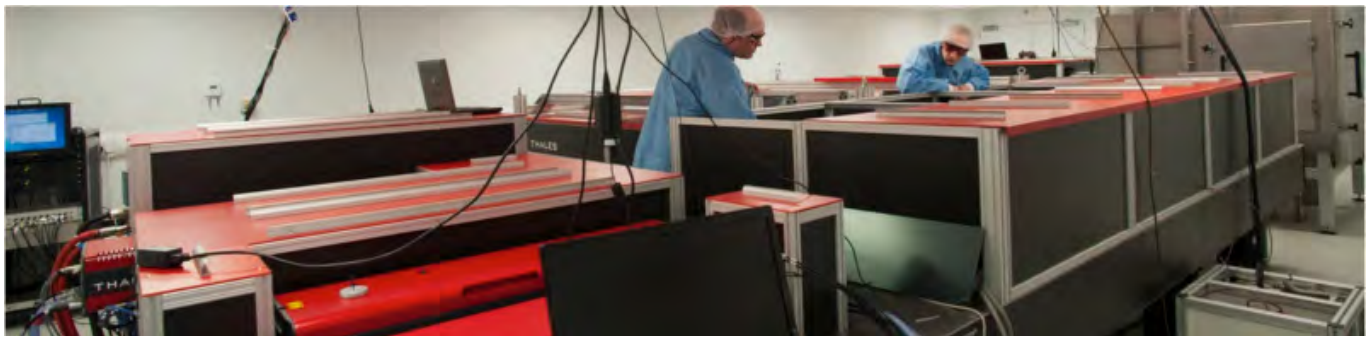


Image: Strathclyde/Thales.

SUPA powerful: SCAPA's new 350TW laser system.

One of the world's most powerful lasers – which can produce beams with a peak power of 350 terawatts for 25 femtoseconds and produce up to 14 Joules of energy per pulse at 5 Hz – has been acquired by Scotland's University of Strathclyde.

The £3.5 million device, supplied by Thales, can deliver peak powers with the highest repetition rate of any laser currently operational in a university laboratory, and can briefly recreate the physical conditions, such as the pressures and temperatures, found in stars.

The installation, which commenced in early 2017, follows Thales winning the tender in 2015 from the Scottish Centre for the Application of Plasma-based Accelerators (SCAPA), which is based at the university.

SCAPA's research is focused on the development of next-generation accelerator and radiation source technology. The SCAPA research centre is a major initiative within the Scottish Universities Physics Alliance project.

Once completed, the new laser facility will comprise three radiation shielded areas housing seven beam lines due to be completed at the rate of one every six months or so. Developing medical, industrial and scientific applications of laser-accelerator and radiation source technology is at the heart of SCAPA.

Cancer therapy

The laser has numerous scientific applications including medical imaging, radiotherapy and generation of radioisotopes for imaging and cancer therapy.

Dr Gregor Welsh, a Research Fellow in Strathclyde's Department of Physics & Laser Manager of SCAPA, commented, "This is a world-leading laser for any university – indeed, we believe it is the highest average powered lab-based laser of its type anywhere in the world.

He said, "The new laser will act as a light source that drives the applications and produces X-ray pulses short enough to take snapshots of molecular or solid state processes."

Professor Dino Jaroszynski, director of SCAPA, added, "Our acquisition of this type of laser reflects Strathclyde's status as a world-leading centre of physics. Its important applications underline Strathclyde's international reputation for significant research with impact. It also forms part of a valuable training facility for our PhD students."

He added, "We innovate both in the science and in the way we do the science."

The Research Excellence Framework 2014, the comprehensive rating of UK universities' research, ranked the University of Strathclyde's Physics research first in the UK, with 96% of output assessed as world-leading or internationally excellent.

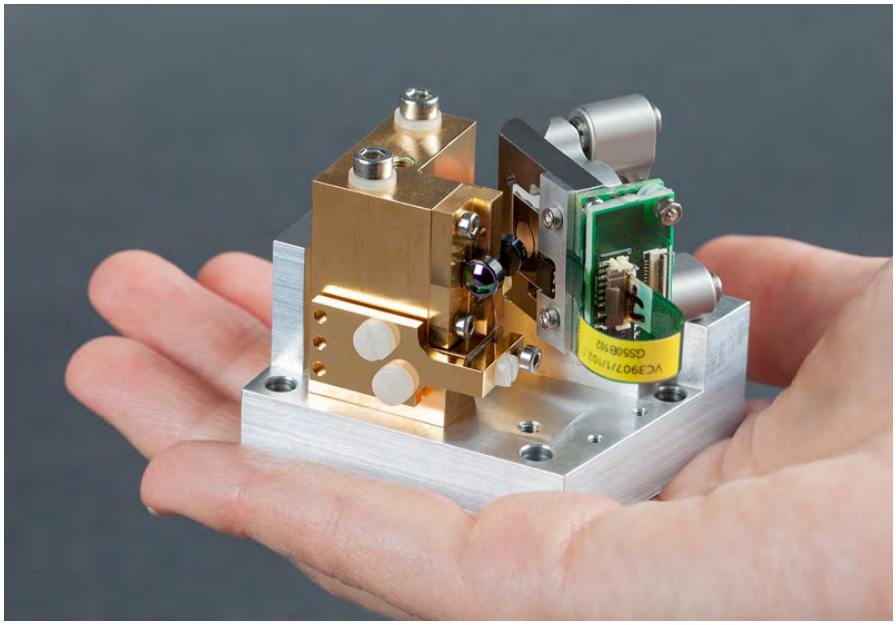
Dr Welsh added, "We already have an older, smaller laser system producing 40TW pulses, which is still in use as part of the SCAPA project."

http://optics.org/news/8/5/31

MIRPHAB partners 'transforming' QC laser production

Quantum cascade devices for the EU-funded pilot line can be wavelength-tuned at a rate of 1 kHz.

Three different Fraunhofer institutes involved in the European Union-funded pilot line project known as "MIRPHAB" say that they are helping to transform the production of quantum cascade lasers (QCLs) for future industrial applications.



Demonstrator of the miniaturized QC laser source, which features a MOEMS-based grating scanner for rapid wavelength tuning.

Short for Mid InfraRed PHotonics devices fABrication for chemical sensing and spectroscopic applications, MIRPHAB officially kicked off at the start of 2016, and is set to run for four years with a budget of €17 million.

The plan is to provide a reliable supply of photonic components operating in the mid-infrared spectral region – also known as the "fingerprint" region, where the highly wavelength-specific vibrations of chemical bonds can be used to identify molecules.

Rapid switching

While the pilot line project is co-ordinated by the CEA-Leti laboratory in France, the three Fraunhofer institutes are closely involved with the provision of QCLs to provide the mid-IR light needed for the packaged sensor devices.

Team members at the Fraunhofer Institute for Applied Solid State Physics (IAF) in Freiburg and counterparts at the Fraunhofer Institute for Photonic Microsystems (IPMS) in Dresden have now developed a demonstrator version of a miniaturized source, comprising a QCL chip and a MEMS-based grating scanner that is able to switch wavelengths at a rate of 1 kHz.

"In this type of laser, the wavelength range in which the light is emitted is spectrally very broad and can be customized during manufacturing," explain the Fraunhofer partners. "In order to select a specific wavelength within the wide spectral range, it has to be chosen via an optical diffraction grating and coupled back into the laser chip. By rotating the grating, the wavelength can be tuned continuously."

Those gratings are made at IPMS, with more consortium members at the Fraunhofer Institute for Production Technology (IPT) in Aachen working on ways to optimize the production of both laser chips and gratings, with a view to series production and the kind of cost reduction that will be required for applications in industrial sensing, healthcare, or forensic science.

Automated process monitoring

Fraunhofer IAF points out that in such applications, for example to identify and monitor a specific chemical substance, a customer would typically have very individual requirements.

"This starts with the substances to be accounted for, [and] the number of required sensors, up to the speed of the production process," it reports. "In most cases, a 'one-size-fits-all' solution is not sufficient, and several suppliers are needed in order to develop the optimal individual solution."

With MIRPHAB, that changes – customers can access mid-IR sensor technologies tailor-made for their requirements, from a single source.

"Interested parties can address a central contact person, who then compiles the best possible solution from the component portfolio of the MIRPHAB members according to the modular principle," say the Fraunhofer partners. "In addition, MIRPHAB gives companies access to the latest technologies, enabling them to gain an edge over the competition as an early adopter."

With the ability to record up to 1000 spectra per second now available, monitoring and control of chemical reactions and biotechnological processes is possible in real time - suggesting that future deployments in "Industry 4.0" applications are likely.

Other QCL partners involved in the pilot-line effort include Switzerland-based Alpes Lasers, and the French company mirSense, which was spun out of the III-V Laboratory near Paris, previously set up by Alcatel-Lucent and now operated by Nokia, Thales and CEA.

Cascade Technologies - now part of the giant US-headquartered industrial process technology firm Emerson - is also partnering at the demonstrator level.

By Mike Hatcher, Editor, optics.org

http://optics.org/news/8/5/59

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Supercontinuum goes industrial with new SuperK EVO line

Optimized for reliability, footprint, and cost, the new SuperK EVO white light lasers from NKT Photonics is ideal for OEM integration in demanding commercial applications.

The EVO can be configured with output power levels anywhere from 100mW up to 10W with MHz repetition rate. The output spectrum covers 400-2400 nm and comes fiber delivered through a broadband collimator.

The EVO line is also available as cost-effective stand-alone lasers for laboratory use, where the first model is a 20 MHz, 3W laser aimed at lifetime applications.

Contact Details
NKT Photonics
Blokken 84
3460 Birkeroed
Denmark
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ID Quantique SA
Ch, de la Marbrerie, 3
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Suisse/Switzerland
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Schäfter+Kirchhoff provide laser line generators in the wavelength range 405 to 1550 nm.

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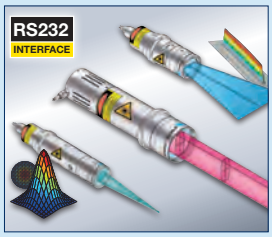

Contact Details
Schäfter+Kirchhoff GmbH
Kieler Str. 212, D-22525 Hamburg
www.SuKHamburg.com
info@SuKHamburg.de
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Trumpf teases ultrashort 'game-changer' in Munich

Laser company says it will reveal way to combine ultrashort pulses with fiber delivery at LASER: World of Photonics event.

Germany-headquartered laser and machine tool company Trumpf says that it will unveil a new way to integrate ultrashort-pulsed lasers with fiber delivery at next month's LASER: World of Photonics show in Munich.

In a pre-show company announcement Trumpf Laser's managing director Klaus Löffler said that the "game-changing" development promised a revolution in the field, by overcoming the problem that ultrashort pulses tend to ablate and damage the glass out of which optical fibers are typically made.

"In Munich, Trumpf will present a technology study that has the potential to revolutionize laser material processing with ultrashort pulse lasers," teased the company, with Löffler adding:

"Some 30 years ago, the first laser light cable suitable for industrial use proved the breakthrough for solid-state lasers; our new beam guidance concept promises to do the same for ultrashort pulse lasers today."

Thermal effects minimized

Because it transfers energy to a target material in such a short time, an ultrafast laser pulse generates only minimal thermal effects - offering enormous potential for extremely precise "cold" materials processing, without any distortion caused by melting.

However, the incompatibility with conventional glass fibers, coupled with the relatively high cost and less robust nature of the technology compared with other sources means that those advantages are yet to transfer to industry in significant volumes.

Trumpf's current line-up of laser products includes the "TruMicro" series, which features nanosecond, picosecond and femtosecond pulse sources. Femtosecond versions of the "TruMicro 5000" laser offer up to 125 µJ energy with a 900 fs pulse, and an average output power of 120 W.

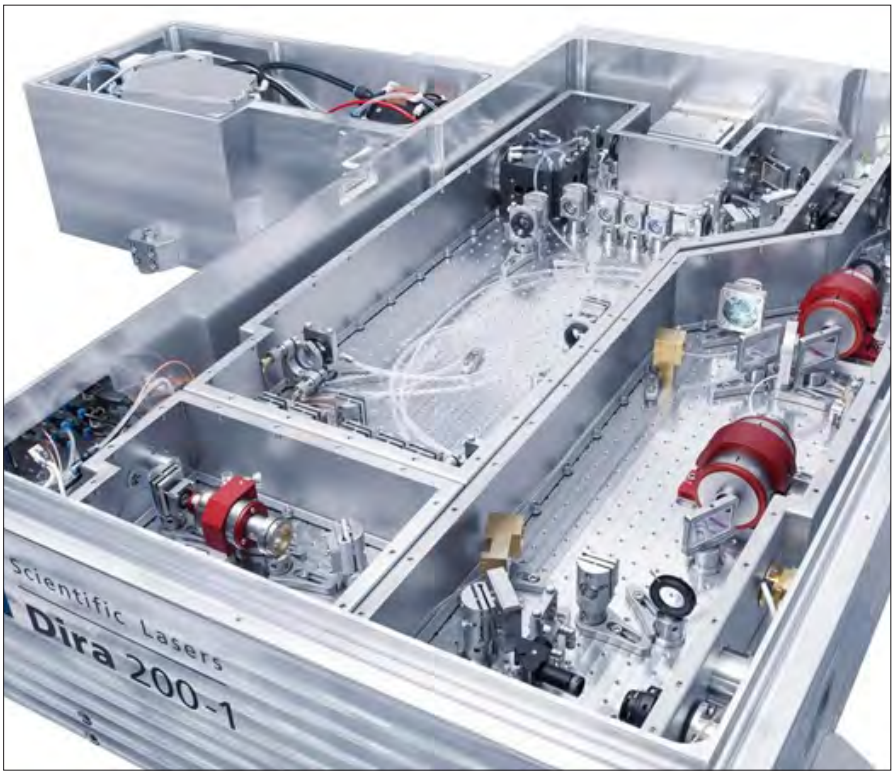

Photo: TRUMPF Group.

Trumpf's Dira-branded scientific lasers, developed with ultrashort pulse pioneer Ferenc Krausz and colleagues, will be among many showcased on the company's giant LASER World of Photonics stand in Munich next month.

Attosecond pulses

Aside from the ultrashort pulse delivery technique, Trumpf says that it will debut a diode laser said to offer sufficiently good beam quality for industrial applications beyond soldering, hardening and deposition welding, as well as the second release from its new generation of disk lasers for industry.

The company's disk-based "Dira" series of laser amplifiers for scientific applications will also be showcased on Trumpf's large (600 m2) exhibition booth in Munich.

This technology, based on cutting-edge research by Ferenc Krausz and colleagues at the Max Planck Institute of Quantum Optics in Garching, delivers picosecond pulses with up to 200 mJ of energy – and can be used to generate so-called "few-cycle" pulses in the attosecond regime.

Special models with a pulse energy up to the joule level or average powers of a kilowatt are also available upon request, says Trumpf, which set up the Scientific Lasers venture with Krausz and colleagues back in 2012 and showed initial products at the LASER 2013 event.

• The latest instalment of LASER World of Photonics will also include a "Start-up World" exhibit in Hall B3 of the giant trade show, enabling companies that are less than five years old to take part at reduced cost.

The founders of some of those new companies will also be taking part in the Photonics Award competition – won by the Swiss firms Nanolive and Femtoprint in 2015, when it was held for the first time.

http://optics.org/news/8/5/32

IPG snaps up OptiGrate for ultrafast laser push

Specialist maker of volume Bragg gratings (VBGs) span out of University of Central Florida in 1999.

Fiber laser giant IPG Photonics has acquired the Florida company OptiGrate, saying that its volume Bragg grating (VBG) technology will be critical as it launches a new line of ultrafast pulsed lasers.

Spun out of the University of Central Florida back in 1999 and based in Oviedo, OptiGrate was majority-owned by the family of its founder Leonid Glebov. His son Alexei, currently general manager, will continue to run the business alongside CTO Vadim Smirnov following the deal.

New ultrafast pulsed lasers on the way

IPG was already an OptiGrate customer, and says that VBG-based components enable a dramatic performance improvement, as well as miniaturization and cost reduction for ultrafast pulsed lasers used in micro materials processing and other applications, including medicine.

Felix Stukalin, IPG's senior VP of operations for North America, said in a company release: "As the technology leader in volume Bragg gratings and thermo-refractive glass, OptiGrate will help IPG develop new leading-edge solutions and improve our current products and components."

He added: "IPG is intensely focused on advancing the use of lasers around the world and the technology used in them. As such, the acquisition completes IPG's internal set of core components for our revolutionary new ultrafast pulsed laser product lines that we are introducing to the market."

Alexei Glebov told optics.org that OptiGrate's approximately 40 employees would continue with the company as part of IPG, with the parent firm promising to honor all existing customer commitments while further expanding the market for VBGs.

IPG added that it expected OptiGrate's operational location to remain in Oviedo. Back in 2012, Optigrate completed a 10,000 square foot expansion in the Orlando suburb, in response to fast-growing demand for its products. VBGs can also be used to scale laser power through wavelength beam combining.

The expansion was entirely self-financed, with Alexei Glebov saying at the time: "Over many years we sustained organic profitable growth, and we always reinvested our profits in expanding our technology base and production capabilities."

Record sales and stock price

Earlier this month IPG posted yet another record in its latest quarterly financial filing, as sales jumped 38 per cent year-on-year to $286 million and net income rose even more sharply, to $74.9 million.

The Oxford, Massachusetts, company's strong competitive position – the company is highly vertically integrated, and produces critical high-brightness laser diode components internally – and the apparently insatiable demand for fiber lasers has seen its share price rocket to record levels in recent weeks.

Shortly after announcing the OptiGrate deal, the stock rose another 2 per cent in value, to stand at just over $139 on the Nasdaq exchange. At that current level, the company commands a market capitalization of around $7.5 billion.

Photo: OptiGrate.

Thanks to profitable operation since spinning out of the University of Central Florida (UCF) in 1999, OptiGrate was able to self-finance its 2012 expansion in Oviedo, and remain majority-owned by the Glebov family. UCF had retained a small shareholding in the company but no venture backers were involved.

http://optics.org/news/8/5/41

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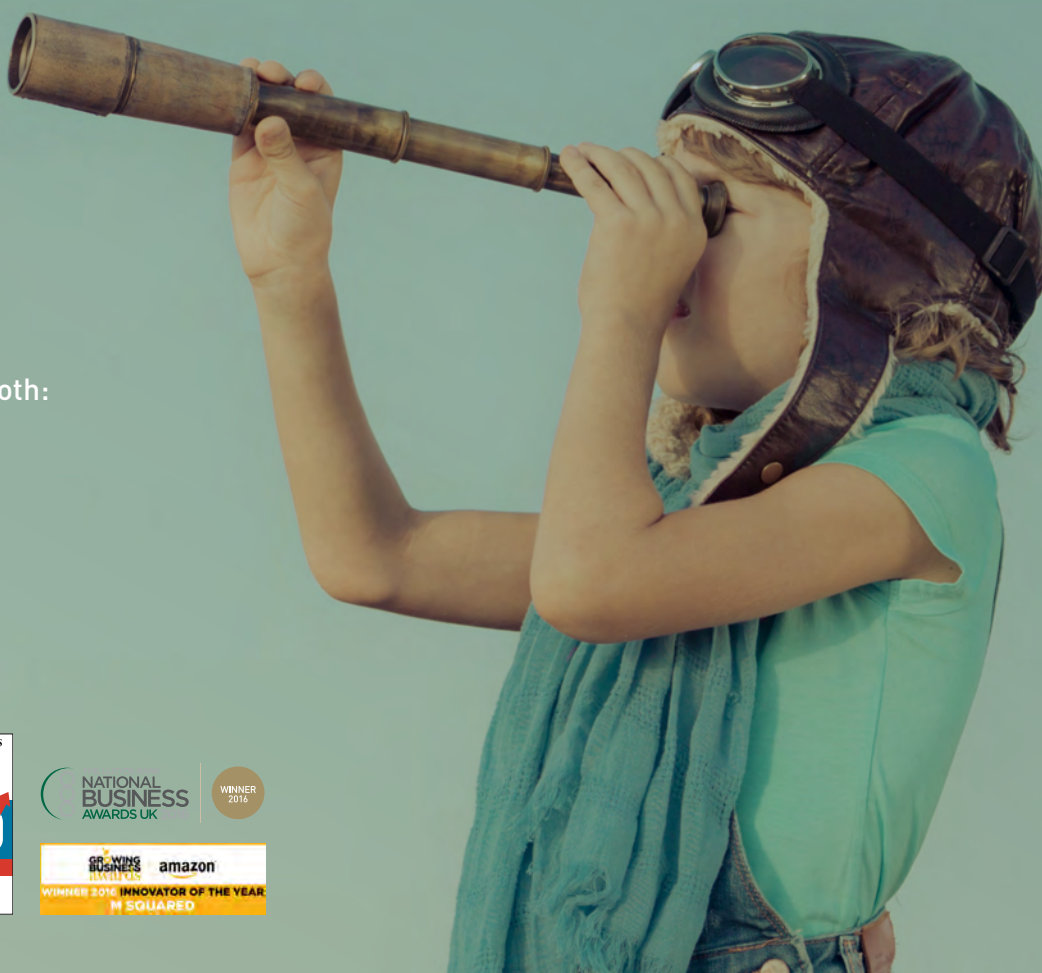

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Photo: ESO/Schott.

Opening of the ELT M2 blank mold containing the still extremely hot Zerodur glass, following first annealing at the Schott 4 meter blank annealing facility in Mainz, Germany, earlier this month. The completed mirror will weigh 3.5 tonnes, be the largest secondary mirror ever employed on a telescope, and also the largest convex mirror ever produced.

Schott casts giant mirror blank for Extremely Large Telescope

European Southern Observatory says 4.2 m-diameter secondary mirror will weigh 3.5 tonnes.

The European Southern Observatory (ESO) says that the casting of the secondary mirror blank for its Extremely Large Telescope (ELT) project – the largest convex mirror ever produced - has been completed by glass and optics provider Schott, in its signature Zerodur glass-ceramic material.

At 4.2 m in diameter, the giant optic will weigh in at 3.5 tonnes, and is set to become the largest secondary mirror ever employed on a telescope once the instrument is completed.

ESO adds that the secondary mirror is strongly curved and aspheric, and therefore presents a major challenge to both make and test.

Exoplanet spectroscopy

Under early construction at the summit of Cerro Armazone in Chile, the optical and near-infrared telescope will feature a 39.3 meter diameter segmented primary mirror, and use adaptive optics with a deformable quaternary mirror to correct for image fluctuations caused by the Earth's atmosphere.

As a result, once operational the ELT should be able to generate even sharper images than the Hubble Space Telescope, despite being Earth-bound. Among other applications, it will be used to search for the spectroscopic signatures of water and organic molecules in exoplanet atmospheres.

The project, currently slated for "first light" in 2024, represents the largest telescope of its kind anywhere in the world. Alongside nearly 800 hexagonal segments making up the primary mirror, it will feature an unusual concave tertiary mirror weighing 3.2 tonnes, and six laser guide stars for adaptive optics correction.

ESO executives signed the casting contract for the secondary and tertiary mirrors with Schott as recently as January, alongside deals for mirror support cells and edge sensors for the primary mirror segments.

continued on next page

continued from previous page

Schott casts giant mirror blank for Extremely Large Telescope

The German company has already delivered blanks for the thin, deformable shell mirrors that will make up ELT's quaternary optic. The deformable elements will also feature a new type of piezo actuator under development between Physik Instrumente and the Fraunhofer Institute for Applied Optics and Precision Engineering in Jena.

"A new milestone has now been reached with the casting of the telescope's secondary mirror (M2), which is larger than the primary mirror of many of today's research telescopes," announced ESO.

Zerodur

Schott used its proprietary "Zerodur" glass-ceramic material to produce the blank. The lightweight material maintains its shape under extreme temperature variations, and has been widely used for astronomical telescopes - including for example the airborne "SOFIA" telescope on board an adapted Boeing 747.

The company has a long-standing relationship with ESO, and produced the 8.2 m-diameter main mirrors for the Very Large Telescope, part of the Paranal Observatory also based in Chile.

Following the high-temperature production process, the secondary mirror must now be cooled slowly, after which it will be subject to a sequence of machining and heat treatment steps over the next 12 months.

After that, it will be ground and polished to ultra-high precision by French firm Safran Reosc. "The blank will be shaped and polished to a precision of 15 nm across the entire optical surface," noted ESO.

Once installed, the secondary mirror will hang upside down above ELT's primary mirror, forming the second element of the novel five-mirror optical system.

By Mike Hatcher, Editor, optics.org

http://optics.org/news/8/5/39

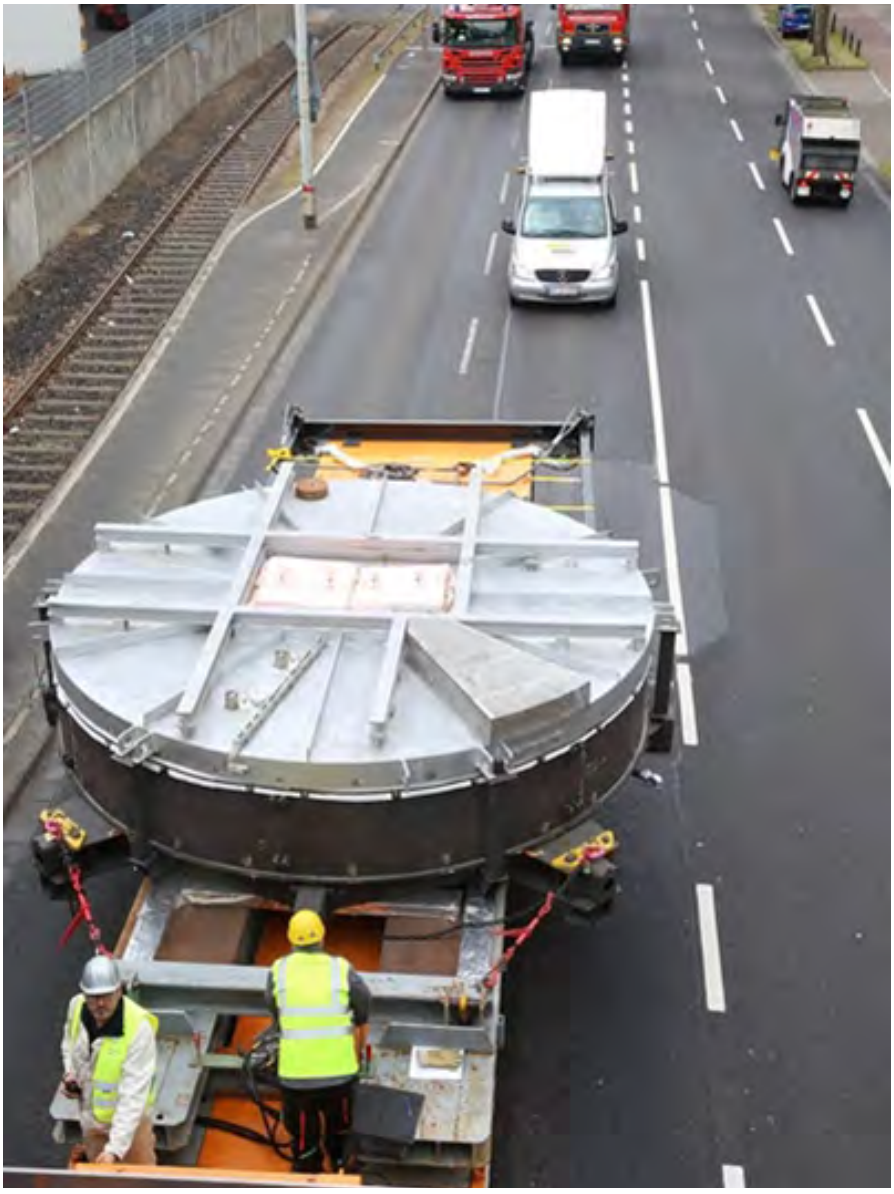

Photo: ESO/Schott.

Transfer of the secondary mirror blank to Schott's annealing facility in Mainz, Germany. The blank was cast out of Zerodur, a material originally developed for astronomical telescopes in the late 1960s. It has almost no thermal expansion - even when subjected to large temperature fluctuations - is highly chemically resistant, and can be polished to a high standard of finish.

Photo: ESO/Schott.

Still from the ESO/Schott video showing hot blank transportation.

Rofin deal paying off as Coherent reports 'unprecedented' demand

Sales beat forecasts and profit up sharply as laser company reports its latest quarterly results; stock price soars 10% to all-time high.

Laser giant Coherent has smashed sales forecasts in its latest financial quarter – the first to include a full set of results including 2016 acquisition Rofin-Sinar.

Long-time CEO John Ambroseo reported strong demand across the key application sectors of flat-panel display (FPD) production, semiconductor fabrication equipment, and materials processing, describing current demand as "unprecedented".

As a result, Coherent has decided to accelerate its investment in internal capacity at key sites including its excimer laser system facility in Göttingen, Germany, and its large-optics fabrication center in Richmond, California.

Image: nasdaq.com.

All-time high: following the recent acquisition of Rofin-Sinar and the firm's latest quarterly results, Coherent's stock price soared more than 10% in value to set another all-time high of around $250. That represents a four-fold increase in only 18 months.

Blowout quarter

At $422.8 million for the three months ending April 1, the Californian company's sales revenues were more than double the $199.9 million figure reported a year earlier – although that was before the Rofin had been completed - and way above the anticipated high of $410 million forecast in February.

Photo: Coherent.

While FPD and semiconductor production, along with materials processing applications, represent Coherent's major sales opportunities, the bio-instrumentation sector is also a significant one. The 'OBIS CellX' laser, shown here, delivers up to four separate laser wavelengths from a single module, thereby lowering the complexity and overall cost of laser integration in multi-wavelength life sciences instruments such as flow cytometers.

Net income for the latest quarter came in at $41.8 million, also more than double the year-ago figure. It means that Coherent has now posted a net income of $72.3 million over the first half of its current fiscal year – compared with $38.1 million in the first half of fiscal year 2016.

"We are seeing unprecedented demand across many of our verticals as we capitalize upon market trends as well as research and development investments made over the last few years," said Ambroseo, adding that the largest single opportunity remains in FPDs. Here, the general industry transition to organic LED (OLED) screens plays into Coherent's hands, since it supplies large excimer laser systems that are used for a key annealing step in volume production.

As a result of demand from the FPD industry, Ambroseo told investors, Coherent is set to "pull in" investments in laser system and optics capacity to meet the requirements of its customers.

Examples of the demand growth in terms of display area come from the recent launches of around half-a-dozen laptop PCs and a high-end Samsung tablet featuring OLED screens.

Stock at all-time high

Combined with strong increases in demand for high-power fiber lasers, where laser cutting and battery welding applications are providing market traction, and a semiconductor capital equipment industry said by the CEO to be "in high gear", the blow-out performance and optimistic outlook saw Coherent's stock price rise more than 10 per cent in pre-market trading following the latest results call, to an all-time high of $248 when Wall Street opened for business.

Now equivalent to a market capitalization of close to $6 billion, the stock is up from around the $90 mark when the $942 million deal to acquire Rofin-Sinar was first announced.

The acquisition already appears to be paying solid dividends, with Ambroseo noting that the previously separate teams of workers have been able to combine their efforts with minimal impact on their customers.

And thanks to strong cash generation, Coherent has also begun paying down some of the debt finance used to acquire Rofin, and has renegotiated the terms of the debt to a significantly lower rate of interest.

By Mike Hatcher, Editor, optics.org

http://optics.org/news/8/5/24

Lund researchers develop 'World's fastest' film camera

Films at a rate equivalent to 5 trillion frames per second to "freeze" highest-speed chemical reactions, such as combustion.

A research group at Lund University in Sweden has developed a camera that can film at a rate equivalent to five trillion (5 x 1012) images per second, meaning it can freeze events as short as 0.2 trillionths of a second. This is faster than has previously been possible.

The new super-fast film camera will therefore be able to capture incredibly rapid processes in chemistry, physics, biology and biomedicine, that so far have not been caught on film. The work has been published in Light: Science & Applications.

To illustrate the technology, the researchers have successfully filmed how light travels across a distance corresponding to the thickness of a piece of paper. Typically, this transit only takes a picosecond or so, but on film the process has been slowed down by a trillion times.

Photo: Kennet Ruona

Happy snappers: Elias Kristensson and Andreas Ehn.

'Innovative algorithm'

Currently, high-speed cameras capture such images one by one in a sequence. The new Lund technology is based on an innovative algorithm, and instead captures several coded images in a single picture. It then sorts them into a video sequence afterwards.

The method involves exposing the subject of the filming (such as a chemical reaction) to light in the form of laser flashes where each light pulse is given a unique code. The object reflects the light flashes, which are merged into a single photograph. These images are subsequently separated using an encryption key.

The film camera is initially intended to be used by researchers who wish to gain better insight into many of the extremely rapid processes that occur in nature. Many take place at a picosecond and femtosecond scale.

Researcher Elias Kristensson commented, "Although this scale does not apply to all processes in nature, it does to quite a few notable scenarios, for example, explosions, plasma flashes, turbulent combustion, brain activity in animals and certain chemical reactions. We can now film such extremely short processes. In the longer term, this technology could also benefit industry and other areas."

Metamorphosis

For the researchers, however, the greatest benefit of this newly-developed technology is not that they set a new speed record, but that they are now able to film how specific substances change in the same process.

Kristensson commented, "Today, the only way to visualize such rapid events is to photograph still images of the process. You then have to attempt to repeat identical experiments to provide several still images, which can later be edited into a movie. The problem with this approach is that it is highly unlikely that a process will be identical if you repeat the experiment."

The focus of Kristensson and Ehn's research is on combustion – an area, which is known to be difficult and complicated to study. The ultimate purpose of their particular research are is to make next-generation car engines, gas turbines and boilers cleaner and more fuel-efficient; combustion is controlled by several ultra-fast processes at the molecular level, which can now be captured on film.

For example, the researchers will study the chemistry of plasma discharges, the lifetime of quantum states in combustion environments and in biological tissue, as well as how chemical reactions are initiated. In the autumn, there will be more film material available.

Paper conclusion

In their *Light: Science & Applications* paper, the Lund scientists conclude: "To our knowledge, the reported methodology, FRAME, is the first to enable ultrafast 2D-videography having spectroscopic compatibility with both high spatial- and temporal- resolution, down to at least femtosecond timescales. In contrast to existing image coding techniques that rely on translation/sweeping solutions, FRAME is entirely light-based; a boost in frame rate by more than two orders of magnitude is demonstrated herein.

"The simple yet unique ability of FRAME to acquire several laser images in one recording also enables new measurement opportunities. For example, combining FRAME with currently existing laser-methods for fluorescence lifetime imaging (FLI) of single events would allow all FLI data to be collected in one image recording. Finally, the ultimate purpose of single-event videography is to use existing knowledge of ultrafast dynamics gained from studies of reduced systems to understand evolving global systems; we believe FRAME can facilitate achievement of this endeavor."

By Matthew Peach, Contributing Editor, optics.org

http://optics.org/news/8/5/8

Sponsored Editorial

Optikos enables leading-edge technologies with expert optical design and testing

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Accurate camera systems drive safety in automotive industry

As new technologies emerge, stricter and more comprehensive regulations for safety and image quality are being issued by organizations such as the (US) National Highway Traffic Safety Administration (NHTSA), United Nations (UN Regulation No.46), and Autonomous Vehicle Safety Regulation World Congress. Many features now offered as vehicle options will become required life-saving technologies on new vehicles.

Optikos brings a strong track record of creative optical engineering to Camera Monitoring Systems that rely on strict measurement and characterization of image capture, processing and display to ensure safety. Examples include testing wide-field lenses and cameras in a production environment; custom systems that assess the effects of windshields on the performance of forward-looking cameras; and use of LIDAR in self-driving vehicles.

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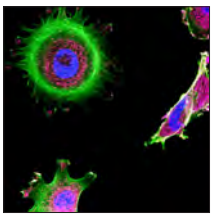

Leading-edge client medical applications with Optikos-enabling technologies range from fluorescence-based diagnostic and cell imaging systems to gene sequencing, dose measurement, minimally-invasive surgery and more.

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Cobolt AB
Vretenvägen 13
SE-171 54 Solna
Sweden
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CINOGY Technologies GmbH

Visit us at Hall A2, Booth #321

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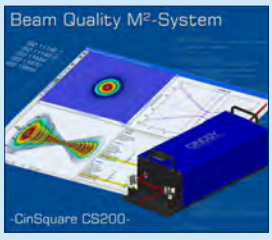
According to ISO 11146-1/2 the system measures the beam caustic and determines M^2, K, BPP, waist position and diameter, divergence, etc. Based on the XML-RPC interface the user can remote control the tool with external applications and allows also the integration into existing production lines.



Contact Details
CINOGY Technologies GmbH
Max - Naeder - Strasse 15
37115 Duderstadt
Germany
www.cinogy.com
info@cinogy.com
Tel: +49 5527 8483770

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Based on NKT Photonics proven supercontinuum technology, the new SuperK MIR infrared supercontinuum laser delivers more than 450 mW of continuous diffraction-limited light from 0.9 to 4.2 µm. The all-fiber architecture ensures stability and maintenance-free operation and the collimated fiber delivery offers great flexibility. The laser is compatible with FTIR spectrometers for fast detection and short integration time over the entire spectrum. Applications of this unique source range from component characterization, mid-IR microscopy, gas and combustion spectroscopy to environmental sensing and standoff detection.

Contact Details
NKT Photonics
Blokken 84
3460 Birkeroed
Denmark
www.nktphotonics.com
sales@nktphotonics.com
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Princeton Instruments

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Contact Details
Princeton Instruments
15 Discovery Way, Acton, MA 01720
USA
www.princetoninstruments.com

Diamond SA

Visit us at Hall B1 Booth #515

F-SMA PSi Connector Power Solution injection

Driven by the growth of laser market Diamond has developed two new F-SMA connector types based upon free standing fiber technology capable of withstanding optical powers of up to several hundreds of watts, to be deployed in industrial, medical, military, an d telecom environments.

The two options are offered in a mode-guider and in a mode-stripper version each one applicable to fibers from 100 µm up to 1000 µm core diameter.

The mode-guider version allows all the modes *(incl. cladding modes)* to propagate with minimum attenuation leading to a higher power transmission and a lower heat dissipation.

The mode-stripper version removes the unwanted cladding modes from the fiber that may be detrimental to other fiber optic elements present along the line.

Contact Details
Diamond SA
CH-6616 Losone
www.diamond-fo.com
info@diamond-fo.com
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Avantes BV

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Contact Details
Avantes BV
Oude Apeldoornseweg 28
7333 NS Apeldoorn
The Netherlands
www.avantes.com
info@avantes.com
Tel: +31 313 670 170

Delta Optical Thin Film A/S

Visit us at Hall B1, Booth #639

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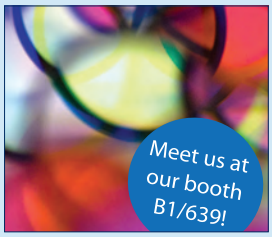

Contact Details
Delta Optical Thin Film A/S
Venlighedsvej 4
2970 Hørsholm
Denmark
www.deltaopticalthinfilm.com
info@deltaopticalthinfilm.com
Tel: +45 70 70 71 46

Iridian Spectral Technologies

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Optical Thin Film Filter Solutions

IRIDIAN Spectral Technologies is a professional experienced resource for your Thin Film Optical Coating requirements. Iridian provides optical thin film filter solutions and coating services to a wide variety of industrial and research sectors. The company is a leading global supplier for applications in machine vision, telecommunications, spectroscopy *(Raman, fluorescence, and flow cytometry)*, biomedical imaging, endoscopy imaging, sensing, display and entertainment *(glasses for 3D cinema, display coatings)*. Our optical filters and coatings cover the spectral range from UV 300 nm to LWIR 10 µm. Our products include color filters, narrow band-pass filters, steep edge long pass or short pass filters, dichroic edge filter, notch filter, multi-zone filter and other special coating filters.

Contact Details
Iridian Spectral Technologies
2700 Swansea Crescent
Ottawa, ON, Canada
K1G6R8
www.iridian.ca
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Contact Details
Nanoscribe GmbH
Hermann-von-Helmholtz-Platz 1
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info@nanoscribe.com
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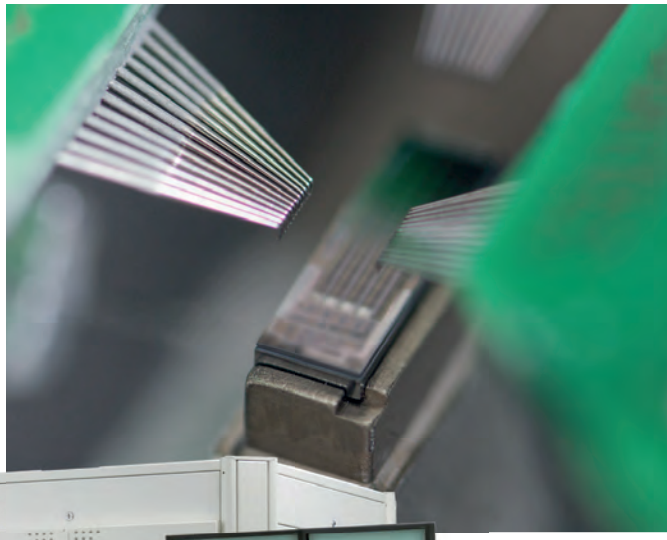

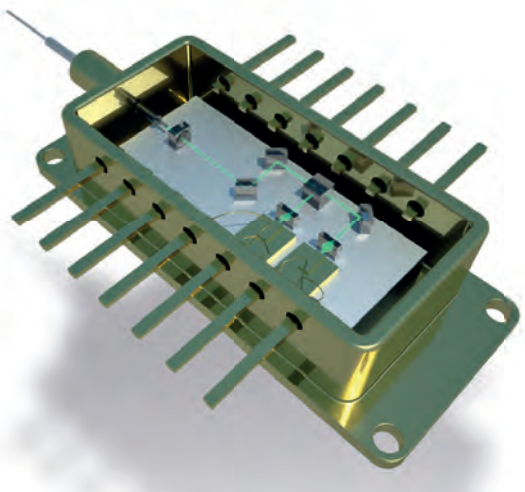

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Cognex acquires Swiss software firm ViDi

Machine vision specialist buys provider of artificial intelligence techniques for improved image analysis.

Massachusetts-based industrial machine vision company Cognex has acquired the Switzerland-headquartered software startup ViDi Systems, establishing a foot-hold in the emerging area of artificial intelligence (AI) in doing so.

The latest of several recent acquisitions by the fast-growing Cognex, the deal was completed on April 4. ViDi claims to be the commercializing the first such software solution to be dedicated to machine vision applications.

Deep learning

According to the two companies, the "deep learning" algorithmic approach developed by ViDi founder Reto Wyss and colleagues uses AI techniques to improve image analysis in applications where it is difficult to predict the full range of image variations that might be encountered.

Using feedback loops, the software is said to be able to "train" the system to distinguish between acceptable variations in images and genuine defects.

Cognex CEO Robert Willett said in a company announcement: "The ViDi team is at the forefront of applying deep learning techniques to the real-world challenges of industrial machine vision.

"We are excited to bring this expertise to Cognex to broaden the scope of applications that can be addressed at a world-class level with Cognex vision."

The deal sees Wyss and his engineering team become part of Cognex's "vision products" business unit, where the software will be integrated into Cognex products and further developed.

While specific transaction terms were not released, Cognex said that the deal would likely have no material impact on its financial results for the next couple of years.

Photo: Vision Show/Messe Stuttgart.

The ViDi software is said to have proved its utility across numerous key machine vision markets, from pharmaceuticals to the automotive sector.

CSEM pedigree

Based in Villaz-St.-Pierre, near the high-tech cluster region of Neuchâtel, ViDi Systems was co-founded in 2012 by Wyss, a computational neuroscientist by training who spent six years as a senior research engineer at the Centre Suisse d'Electronique et de Microtechnique (CSEM) following post-doctoral work at Caltech.

He started the company in collaboration with the CPA Group, a Swiss industrial holding company and business incubator. Cognex says that it will maintain ViDi's operations at the company's current site in Switzerland.

ViDi says that it has field-tested its "ViDi Suite" software successfully in applications including pharmaceuticals, textiles, printing, logistics and the Swiss specialty area of watchmaking.

Last year the software was one of five technologies short-listed for the "Vision Award" at the agenda-setting VISION Show held in Stuttgart, Germany.

"ViDi Suite enables computers, machines and robots to understand images so that they can meaningfully interact with the real world," said the Swiss firm at the time. "It bridges the gap by allowing machine vision companies across multiple industries to create ground-breaking inspection systems [able] to tackle otherwise impossible-to-program [challenges]."

Those include both functional and aesthetic anomalies for inspection and classification.

Cognex, whose sales topped half a billion dollars for the first time in 2016, is one of the biggest systems companies in the machine vision sector, and is also highly profitable.

Its strong cash generation has enabled the firm to stack up hundreds of millions of dollars to support acquisitions and further expansion. Over the past year Cognex acquired no fewer than three smaller firms specializing in 3D vision technology, as well as another focused on barcode verification.

http://optics.org/news/8/4/7

Flir Systems appoints James Cannon new president and CEO

Former director of Stanley Black & Decker and decorated veteran takes over in June, to replace outgoing leader Andy Teich, retiring after 33 years.

Flir Systems has announced that Jim Cannon has been appointed president and Chief Executive Officer, effective from June 19, 2017. He will succeed Andy Teich, whose retirement after 33 years of service was previously announced in February.

Flir-bound: Jim Cannon.

Cannon previously served for more than 16 years in a variety of senior leadership positions at toolmaker Stanley Black & Decker, most recently as President of Stanley Security North America & Emerging Markets. Prior to that, he was President of the company's Industrial & Automotive Repair business unit, in locations worldwide, before then serving as President of Stanley Oil & Gas.

He also served in the US Army for 10 years as an infantryman and armor officer in a variety of assignments, including Operations Desert Shield and Desert Storm in Iraq, where he learned to truly appreciate Flir's technology and was awarded a Combat Infantryman's Badge. He later oversaw key security missions as part of the Army's peace enforcement operations in Bosnia.

"We are delighted to appoint a chief executive of Jim's caliber," said Earl Lewis, Chairman of the FLIR Board of Directors. "Jim's proven track record of achieving strong results in both business and the military make him uniquely well qualified to serve as Flir's next CEO.

Lewis added, "We're confident Jim is the right person to lead Flir. On behalf of the Board, I'm pleased to welcome Jim as we continue to leverage the attributes of the brand and product portfolio to deliver increased value to our shareholders."

'Lifesaving technology'

Cannon commented, "The opportunity to join this team and serve alongside over 3,000 employees worldwide as the Company's next CEO is a great honor. The Flir brand is synonymous with continuous innovation and delivering value to customers around the world.

"From my own personal experience having relied on FLIR technology as a combat veteran, I've seen firsthand the powerful, life-saving impact the company's portfolio of solutions can have for our customers. Andy Teich and the team have done a great job building out Flir's's business, and I'm excited to build on that success and drive furthergrowth."

Cannon serves on the board of directors of engineering and materials company Lydall. He holds a Bachelor of Science degree in Business Administration/Marketing from the University of Tennessee in Chattanooga. He will be based out of the company's Wilsonville, Oregon headquarters.

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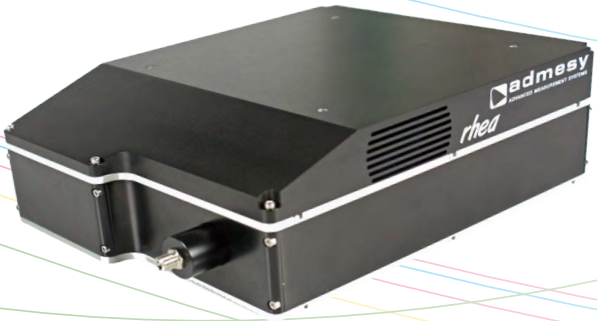

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