THURSDAY
EDITION

SPIE. | optics.org | THURSDAY, JANUARY 22, 2026

PHOTONICS WEST SHOW DAILY

Prism Award winners p. 28

Fetching photons: RealSense brought their robotic dog to the Vision Tech Expo. Credit: Emily Haworth.

Photonics West leads the pack

More than 23,000 register to envision a photonic future built by the industry's best and brightest.

With the sun shining and the San Francisco fog rolling in and out all week, Photonics West took advantage of all the Moscone Center had to offer. Expanding into Moscone West, attendees were exposed to a new expo floor with the introduction of Vision Tech, an exhibit and industry program that showcases the vision and imaging markets.

With more than 23,000 registered attendees from 26 countries, 4,000-plus technical presentations, and more than 1,500 exhibitors, the flow of ideas and connections, old and new, buzzed around the show.

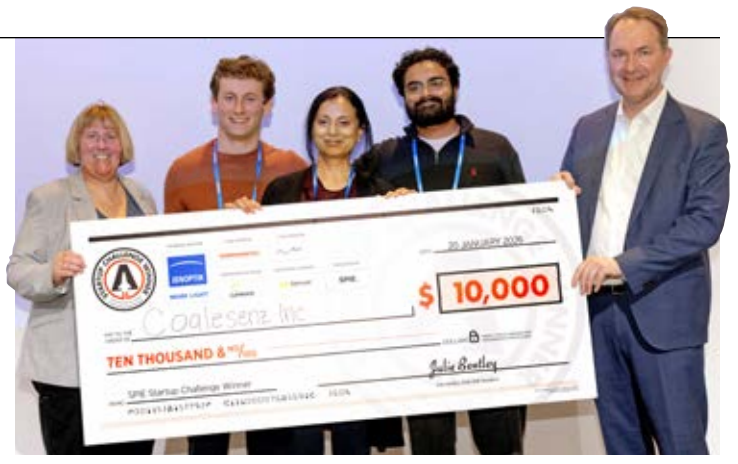
Georg Draude, general manager with Chroma Technology (booth #3425), said, "For me [Photonics West] is about personal connections and meeting all the people here. It's the quality and not the quantity."

"We are located in rural Arkansas, so this is our opportunity to connect with the rest of the industry," said Kirk Warden, president at LaCroix Precision Optics (booth #1454). "[Connections] here have been going very well.

continued on page 03

Coalesenz Inc. claims double win at Startup Challenge

The competition fosters new businesses and potential startups in optics and photonics.



2026 SPIE President Julie Bentley, the Coalesenz team, and Jenoptik's Ralf Kuschnereit. Credit: Joey Cobbs.

With the hum of a busy exhibition floor in the background, Coalesenz Inc. was announced as the first prize, $10,000 winner at the 16th SPIE Startup Challenge on Tuesday. To a standing room only crowd, seven teams pitched their concepts in hopes of winning one of three prizes, in addition to gaining increased visibility with potential investors and collaborators. After each 5-minute pitch, a panel of six judges from the optics and photonics industry had a lightning round of follow-up questions.

The winning pitch from Coalesenz Inc. was for Lucerix CZ, a hand-held blood coagulation analyzer that returns actionable results in 5 to 10 minutes at the point of care. The company was also awarded the $3,000 SPIE Jay Kumler Innovation Award, new to the competition

continued on page 03

DON'T MISS THESE EVENTS.

OPTICAL DESIGN CHALLENGE AWARDS
8 AM – 8:15 AM Moscone West, Main Stage (Level 3)

PHOTONICS WEST EXHIBITION
10 AM – 5 PM Moscone North/South Exhibition Halls

AR|VR|MR AND VISION TECH EXPOS
10 AM – 5 PM Moscone West, Level 1

ACADEMIA-INDUSTRY PARTNERSHIPS: WHY THEY MAKE MORE SENSE NOW THAN EVER
11:30 AM – 12 PM Expo Stage (Moscone South, Exhibit Level)

PAWS FOR A BREAK
1 PM – 4 PM West Hall (Moscone West, Exhibit Level)

WEST HALL NETWORKING RECEPTION
3 PM – 4 PM West Hall (Moscone West, Exhibit Level)

For the full schedule and most up-to-date info, download the SPIE Conferences app. Some events require a paid technical registration.

SPIE PHOTONICS WEST
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IN THIS ISSUE.

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Attendees continued from page 01

We meet existing customers here and we meet many potential new customers."

Steve Sokach, director of sales for SCHOTT North America (booth #1341) said, "We've been involved [with Photonics West] from the beginning." When asked what keeps SCHOTT coming back each year, Sokach replied, "These opportunities, seeing how the market has developed, seeing what's new in the industry, seeing the evolution of products. Just the ability to network with so many customers at one time. Also to get a gauge as to what's new and emerging, where we need to play." He added, "This is great market intelligence for us. To give a simple indication, fifteen years ago there was no AR/VR hall, and now [SCHOTT] has a prominent display (booth #6420) in the AR|VR|MR Exhibition because of some of the things we have learned by coming to exhibitions like [Photonics West]."

Brooke Nagle, senior manager of marketing and communications with Optikos (booth #441), was attending Photonics West for the first time. "Everyone has been incredibly welcoming, and everything is very well-labeled, which I appreciate." When asked about the connections she has made during her time exhibiting, she said, "I feel like I haven't been able to leave the booth because there are so many people walking around, simply being curious, and I think the curiosity is something that sets this show apart. [Photonics West] feels like less of a sales push and more of a conversation."

Stacie Foster, marketing manager with TOPTICA Photonics (booth #3501) and veteran of the show, challenged attendees to test their internal clocks with the exhibitor's in-house Optical Quantum Clock. She said matter-of-factly, "We always leave [Photonics West] with focus and new ideas. SPIE does it the best."

LINDSEY MCGUIRK

Universal Photonics celebrates centenary

Universal Photonics, Inc. (UPI) kicked off its 100th anniversary celebrations at booths 1748 and 1749 in the Photonics West exhibition this week. Founded in Brooklyn, NY, in 1926, initially as the Universal Shellac and Supply Company, the polishing and processing expert says it has spent a century evolving alongside the optics and photonics industries while adapting to technological change.

"Over multiple generations of family leadership, Universal Photonics has supported customers through decades of advancement in optical manufacturing, continually refining surfacing consumables, equipment, and processes to meet increasingly complex demands," announced UPI, whose headquarters are now on Long Island.

"Reaching 100 years reflects our ability to adapt and grow with the industry," added current CEO and President Neil Johnson. "Every era brings new challenges, and our focus has always been on helping our customers move forward."

Recent developments have seen a significant expansion in southeast Asia, with a new office in Ho Chi Minh City, Vietnam, opened last October—UPI's sixth location in the region. Charles Ritter, who heads UPI's far-East operations, said: "As the next generation steps into the business, we remain focused on advancing surfacing technologies for what's ahead."

MIKE HATCHER

Metasurfaces: A new "wheel" for live cell imaging?

While researchers have several methods for imaging live cells in a petri dish—many of them excellent—each has drawbacks which can include poor contrast, small imaging areas in microwells, and having to kill cells to see inside.

What to do? "Of course, you don't want to reinvent the wheel unless you have to," said Cornell University Professor of Applied and Engineering Physics Gennady B. Shvets. But in this case, the proverbial wheel is a combination of a petri dish and microscope. "So, if we can somehow come up with a better petri dish and a better microscope, that would be like reinventing the wheel for cell biology."

Gennady B. Shvets. Credit: Cornell University.

The Shvets group's new "wheel" is called metasurface enabled epi-illumination microscopy. It allows for real-time monitoring of cellular movements without killing or damaging cells. He described the set up at a keynote presentation on Tuesday. The basic setup consists of metasurface nanostructures at the bottom of a microwell "and then we use an infrared source, typically a quantum cascade laser to do heavy illumination imaging and look at the cells in refraction," Shvets said.

The metasurfaces are essentially an array of metallic antennas designed to absorb infrared radiation at the right frequencies. "And if you illuminate a metasurface with a light which is tuned to the resonant frequency, you will get very strong field enhancement at the tips of the antennas."

When a cell rests on a metasurface that nanostructure's reflective properties change "and we are reporting how those changes are happening," Shvets continued. "And this is what allows us to do time-lapse imaging. We can look at very basic phenomena like metabolism."

Mid-infrared spectroscopy, Shvets said, is a label-free and cell friendly assay, in a spectral range between 3 and 12 μm. "And the reason it's an important range is because it corresponds to various molecular vibrations of various modes. For example, if you're interested in looking at the nucleus, a nucleus is going to contain lots of DNA and RNA. And DNA and RNA will contain various phosphate groups that have their own resonances. So, you can basically tune your source to the frequency of those vibrations.

Why cell friendly? "The frequency of a mid-infrared photon is very low," Shvets said. Microbes are not damaged by any kind of short wavelength radiation.

The upshot of this imaging apparatus is "a hypercube of absorbance data," Shvets said. Most importantly, perhaps, is information about the effects of different stimuli. "So, for example, if you add a drug, you can monitor, as a function of time, what is happening to a cell after this drug has been added. You get very multi-dimensional data from this." Among the important possible applications would be testing of drug compounds for personalized medicine in treating cancer.

"We're making these [metasurface] structures using standard semiconductor replication techniques," Shvets said. "And the idea is that eventually we will be able to accelerate personalized drug discovery using these smart attributes."

WILLIAM G. SCHULZ

Startup Challenge continued from page 01

this year. Jay Kumler, the former president of JENOPTIK North America and SPIE Fellow, passed away last year. He was a leader and mentor in the industry as well as an avid supporter during the founding of the Startup Challenge. Co-presented with Jenoptik, this award is given to the entrepreneur whose work best demonstrates Kumler's commitment to advancing optics and photonics innovation honors.

"This is tremendously exciting," Coalesenz Inc., founder, **Seemantini Nadkarni,** said, after her big win. "I've been involved with SPIE since I was a PhD student a long time ago. I started off in medical imaging and then moved into optics. We always come to the Startup Challenge and it's really awesome to be a part of it, and also win today."

The second place, $5,000 prize went to SPKL LLC for the SPKL Flow Monitor, a low-cost, portable monitor that can detect a stroke ahead of a patient arriving at a hospital. Seaborough was announced as the third place, $2,500 prize winner, for the EuroLED®, a nano-engineered phosphors delivering brighter light, lower carbon, and real savings.

"We're very excited," said **Arnold Estrada,** CEO and co-founder of SPKL LLC. "The notoriety I think that we'll get from placing in this competition will be invaluable."

"It's very nice to get confirmation, especially from this type of audience, that what we're doing is meaningful and interesting," Seaborough CEO and CTO, **Marie Anne van de Haar,** said. "I've already made some connections." Although this was van de Haar's first SPIE Startup Challenge, she's attended Photonics West for nearly a decade. "I love the exhibition. It's a great way to connect. It's so large, there's something for everyone."

The SPIE Startup Challenge provides an entry point for new optics and photonics businesses and potential startups working on novel products, applications, and technologies within the areas of healthcare and deep tech. Many previous SPIE Startup Challenge recipients have gone on to wider commercial success, including, Double Helix Optics and PhotoniCare. In addition to Founding Sponsor Jenoptik, the Startup Challenge is also supported by lead sponsors Avo Photonics and Hamamatsu, and Supporting Sponsor Luminate.

LINDSEY MCGUIRK

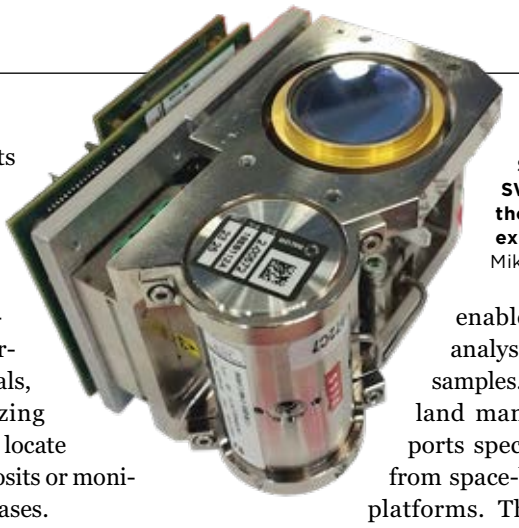
Lynred brings ‘space-grade’ spectroscopy down to Earth

A changing climate and policy changes are putting pressure on food security and access to climate data, making the ability to accurately analyze soils, materials, and gases one of the strategic challenges of the day. To address this, Lynred (booth #1866), a developer of infrared imaging technologies, has launched the Sirocco SW, an extended-SWIR (eSWIR) detector designed for industrial and environmental applications that now stand to benefit from the Veurey-Voroize, France, firm’s space-qualified technology.

“Until now, this level of eSWIR performance was largely confined to space applications,” says Pierre Jenouvrier, Cooled Product Unit director at Lynred. “With Sirocco SW, we are making that capability accessible to industrial and environmental users who need better data.”

Positioned in a fast-growing market, Sirocco SW is available in two configurations: as a focal plane array for custom integration, or as a packaged detector within Lynred’s standard PlugUp platform. A space-enhanced cryogenic design is under development for new space applications and should be available soon, Jenouvrier adds.

Capable of detecting wavelengths up to 2.5 µm in VGA resolution (640 × 512 pixels), Sirocco SW extends spectral analysis beyond the limits of conventional SWIR sensors.



Lynred’s “Sirocco SW” extended-SWIR detector at the Photonics West exhibition. Credit: Mike Hatcher.

This range is required for identifying chemical species, differentiating materials, and characterizing soils—whether to locate new mineral deposits or monitor greenhouse gases.

At the core of Sirocco SW lies Lynred’s MCT (mercury cadmium telluride) technology, developed and qualified through space programs. Unlike InGaAs-based SWIR sensors, typically limited to 1.7 µm, MCT enables reliable detection up to 2.5 µm, significantly expanding the usable spectral window for spectroscopy.

For the mining sector, the detector enables more accurate analysis of soil and rock samples. In agriculture and land management, it supports spectral soil mapping from space-borne or airborne platforms. The same spectral capabilities also strengthen environmental monitoring, including the detection of carbon dioxide, carbon monoxide, methane, and nitrous oxide. In industrial settings, Sirocco SW can also be used for high-temperature process control above 300°C, combining the benefits of SWIR and thermal detection.

MATTHEW PEACH

Coherent shows VCSEL solution for quantum links

Photonics giant Coherent and Quside, a quantum technology spin-out from Barcelona’s Institute of Photonic Sciences, claim to have “reached a major milestone in hardware-based security” by demonstrating a mass-manufacturable quantum entropy source. They say that the breakthrough, using a vertical cavity surface-emitting laser (VCSEL) source already made in volume by Coherent, shows that fast, verifiable quantum entropy—an essential requirement for secure digital systems—can be embedded at scale, supporting new security architectures.

The solution, which also relies on Quside’s quantum random number generators, is being demonstrated at Coherent’s Photonics West booth (#4805) this week, alongside development kits.

The partners state that “for the first time, run-time entropy verification from a single VCSEL delivers high-quality, observable randomness suitable for cryptographic key generation, secure communications, and emerging quantum-safe and crypto-agile systems.”

Giovanni Barbarossa, Coherent’s chief strategy officer, explained: “VCSEL technology has already demonstrated its reliability and scalability across data centers, sensing, and high-volume optical systems. This new collaboration shows how mature photonic manufacturing platforms can enable entirely new security functions while meeting the cost and scale requirements needed for broad market adoption.”

Carlos Abellán, CEO and co-founder of Quside, added: “Security systems are only as strong as the randomness they rely on. This moves locally verified quantum entropy technology into practical, deployable infrastructure.”

Alongside the VCSEL demo, Coherent is showing off a number of new innovations, including a germanium-free electro-optic modulator designed for high-speed switching of carbon dioxide lasers in semiconductor via drilling applications. It is said to be capable of sub-microsecond pulse generation at laser powers up to 300 W, addressing both performance demands and supply-chain constraints.

The company is also launching “Sapphire XT”, a new mid-power visible laser platform that represents the latest version of its optically pumped semiconductor family. Sapphire XT debuts as a one-box solution with an integrated controller and available at 488 nm, 532 nm, and 561 nm wavelengths, each delivering 1 W of output power from a smartphone-sized unit.

MATTHEW PEACH

Development kit for Quside’s quantum entropy source, based on a VCSEL fabricated by Coherent. Credit: Mike Hatcher.

Oxxius seals deal to acquire 89 North

French high-performance laser manufacturer Oxxius (booth #3566) has acquired the US company 89 North, a developer of advanced laser-based illumination and imaging systems that until this week belonged to fellow exhibitor Chroma Technology (booth #3425).

Done deal: Oxxius CEO Thierry Georges (left) shakes hands on the transfer of 89 North with Newell Lessell, his counterpart at Chroma Technology. Credit: Oxxius.

Described as a “transformational” acquisition supporting the firm’s ambitious growth strategy, the switch is expected to see Oxxius gain operational and commercial presence in the US and across North America, while 89 North will benefit from Oxxius’s established presence in Europe and Asia.

“By integrating 89 North’s technology and know-how, Oxxius will expand its offering, particularly its laser combiner portfolio, to better meet customer needs across multiple markets, with a strong focus on life sciences,” announced the Lannion-based firm.

One particular application area of the Oxxius business to gain from the deal will be microscopy, where 89 North’s laser diode illuminators (LDIs) are used in cutting-edge techniques including super-resolution imaging, optogenetics, and spinning disk confocal microscopy.

Oxxius president and CEO Thierry Georges said: “This acquisition represents a major step forward for our company. 89 North’s solutions are an excellent fit with our portfolio. They will enhance our innovation capabilities while providing us with a strategically important local presence in the US, and providing a European presence for 89 North as well. This transaction also accelerates our next stage of growth, increases our visibility, and strengthens our competitiveness for the long term.” Terms of the transaction were not disclosed.

89 North offers LDIs and a suite of multiline, solid-state laser light engines that are used by researchers in some of the world’s most advanced biosciences labs.

“Our LDIs power up to 1,000 mW of output per laser line via a multimode fiber—all at the price of a low-power LED light engine,” noted the Burlington, VT, firm. “With feedback-controlled output stability and up to a 100:1 linear dynamic range, the LDI is the ideal light source for quantitative imaging, ratiometric imaging, and more repeatable optogenetics experiments. Plus, there is no need for user alignment, and the units are easy to use and maintain.”

MIKE HATCHER

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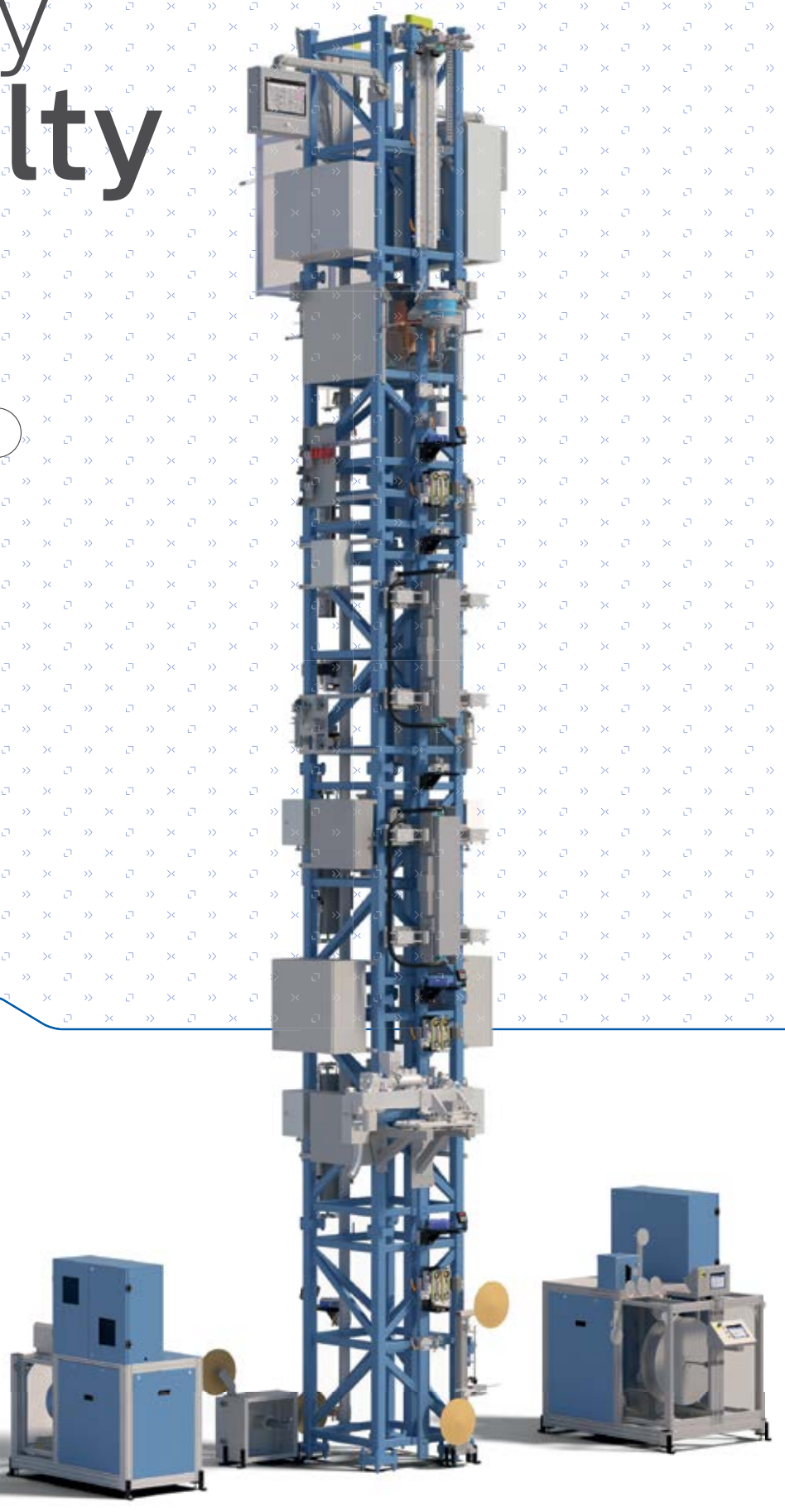

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Graham Reed, silicon photonics pioneer, positions Cornerstone fab (and maybe the UK) for success

It is said that 2026 stands to be a pivotal year for silicon photonics, and SPIE Fellow Graham Reed, a visionary pioneer of the technology, would heartily agree. From his vantage as a professor and research group leader at University of Southampton, director at silicon photonics prototyping foundry Cornerstone, and chair of the SPIE Silicon Photonics conference at Photonics West (among many other distinctions), Reed's views come from the frontlines.

Silicon photonics pioneer Graham Reed. Credit: Cornerstone.

Why this year? Reed says the short answer is the ever-increasing demand for data, particularly to feed the stupendous growth of artificial intelligence (AI). He cites NVIDIA's recent announcement of its Rubin six-chip AI Platform, which uses co-packaged optics (CPO) to overcome networking bottlenecks, as one indicator.

Aside from the mainstream applications, however, "there are a huge number of emerging applications that offer enormous opportunities not on the radars of big players in chip making." Reed cites opportunities for device innovators in areas like healthcare, environmental sensing, imaging that encompasses lidar… "I think all those application areas have emerged really because the success of Cornerstone the last few years has demonstrated that [silicon photonics] really is a viable commercial technology."

"It's not to say the really big guys won't be interested [in emerging application areas] later," Reed continues. "It's early days. It's still what you might call a research activity to a good extent." Healthcare is an enormous market, for example, and Cornerstone is working on innovations like cancer detection on a chip. "It could be in every hospital ward in every doctor's surgery. You know it's a proper game-changer and a proper mass market. And that's just one application in healthcare. There are so many potential applications. It's really an exciting time now."

Reed notes that NVIDIA's Rubin announcement (the platform was named in honor of astronomer Vera Rubin) included a nod to autonomous vehicles. "So that will include various forms of imaging including lidar on a chip. So yeah—exciting times I would say."

Cornerstone's foundries are prototyping silicon photonics chips for applications like AI, healthcare, and lidar. Credit: Cornerstone.

Asked how Cornerstone is strategizing to stay in on the action, Reed says the foundry's background is important. "When we started Cornerstone in 2014, we were only targeting the UK academic community. As university fabs go, we have a very good fab. We don't have what you would call a commercial fab." The idea was to provide prototyping services to researchers who maybe didn't have fabrication capability but now could get some real devices made in a relatively good time.

"Fast forward 10 years and it turns out there are several reasons why particularly small companies but increasing number of large companies as well are interested in using us," Reed explains. First, they often can't get into a big factory because they don't have volume demand. "Secondly, if they can get into a foundry, they might get locked in, or their IP might get covered in some way." At a prototyping stage, it could be too early to know if that foundry best suits the technology.

And that, Reed says, gives rise to the third reason: Cornerstone has always operated open source. "All of our users can use our PDKs [process design kits] free of charge. They don't have to pay licensing fees. And so, we've seen this big increase of industry users, mostly small companies but not exclusively. We have customers in 26 countries, and it's sort of got a mind of its own in many ways. It accelerates the journey of startups, and it supports startups."

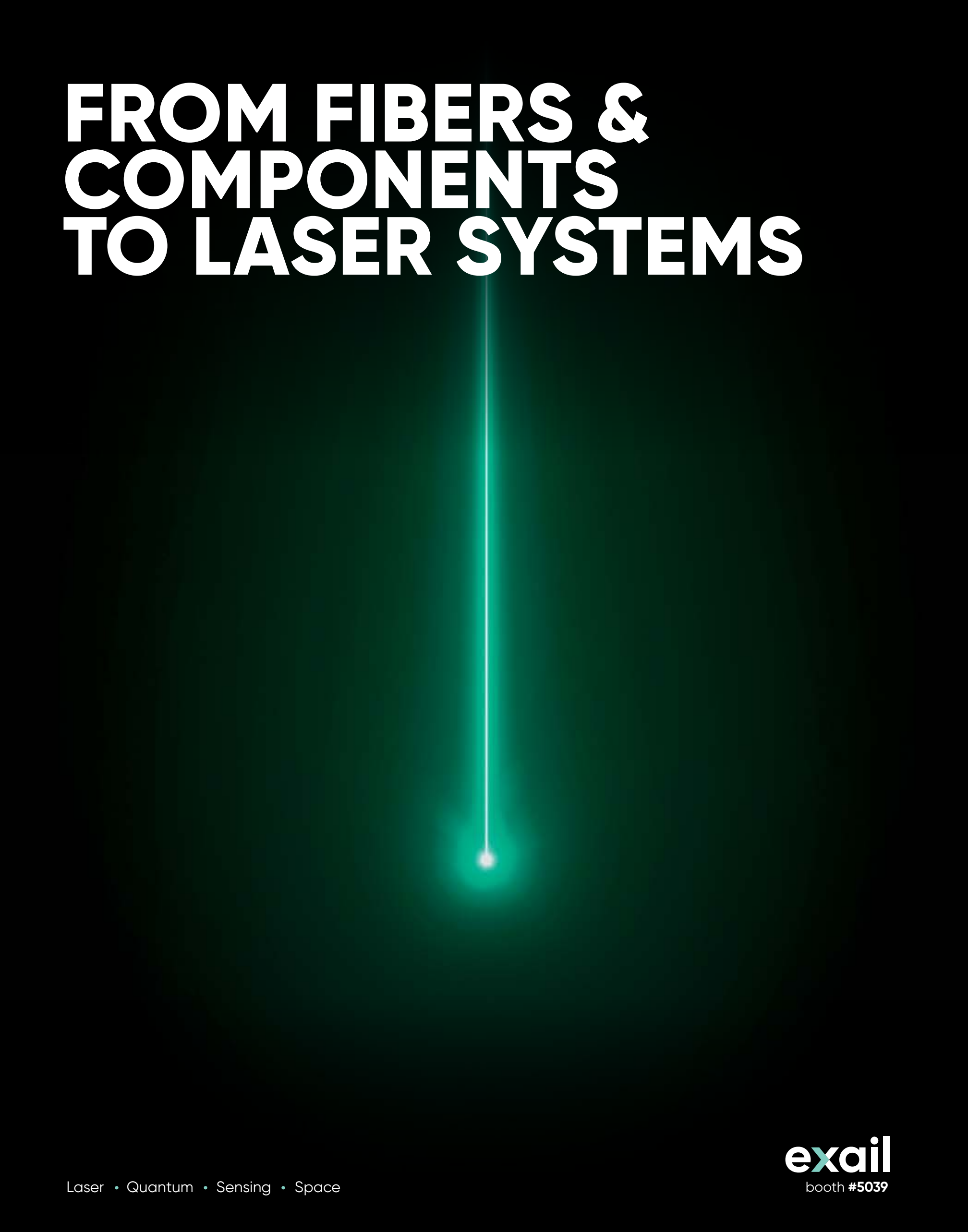
Conerstone's success is part of the UK's emergence as something of a hot spot for widening commercialization of silicon photonics. Reed notes that the first silicon photonics company was started in the UK by one of his students, and at first the action centered on data center comms and just a few big players like Intel and Cisco swooped in and took it outside the country. Now, he says, "there is something of an emerging group of both startups and researchers in the UK. I don't think it's unfair to say that my group is still the leading group. It's more than 80 people now."

Along with semiconductor supply chain concerns in recent years—in the UK and elsewhere—Reed says silicon photonics has landed on the radar of the UK government amid larger discussion of a national semiconductor strategy. That's led to some wins. At a time when government funding in general, and around the world, has been on a downslope, the UK nonetheless invested in two innovation knowledge centers, one being Cornerstone.

"It's proved, I think, very effective," Reed says, "in that we have led policy discussions and engagement. We've provided data directly to government…. It's not the easiest of times. I would like to the see the UK benefit from silicon photonics, since we were pretty much in it from the beginning." Even if it wasn't Cornerstone, he says, he thinks the UK would benefit from a national silicon photonics pilot line that is flexible and license free—all of the things that have contributed to Cornerstone's success. But, he cautions, "if we carry on talking about it for too long and never do anything, we will miss the boat again."

WILLIAM G. SCHULZ

FROM FIBERS & COMPONENTS TO LASER SYSTEMS



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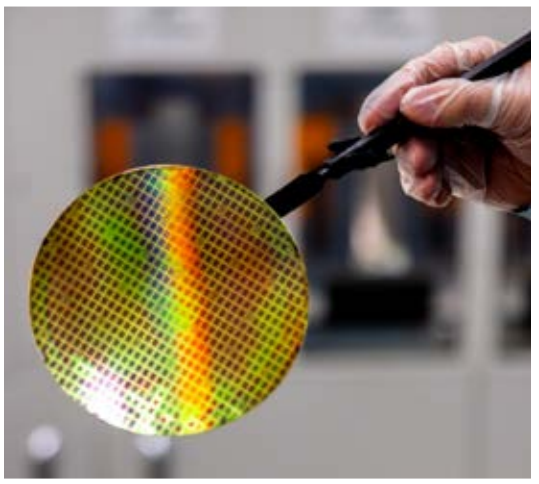
Plessey Semiconductor acquisition seeks to leverage microLED technology

Why Plessey Semiconductor and why microLEDs? Those are questions CEO David Hayes—whose startup Haylo Labs acquired Plessey in August 2025—has asked himself and explored further at his AR|VR|MR plenary talk on Wednesday.

Founded in 1956, Plessey Semiconductors is one of Europe's oldest semiconductor companies and the world's most technically advanced microLED business. The company has developed a fully integrated platform capable of designing, manufacturing, and engineering next-generation display technologies entirely in-house.

Hayes notes that buying Plessey was a good opportunity for Haylo in that microLED is an up-and-coming technology. In fact, it is the main enablement for three fast moving areas in the photonics industry: AR/VR/MR (predominantly AR); optical computing; and optical interconnects. But challenges do exist.

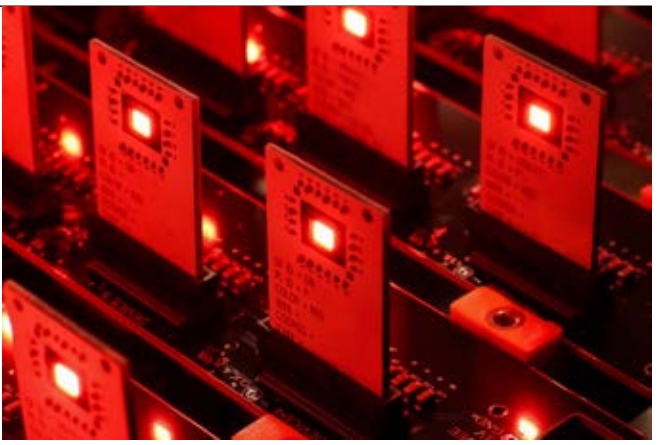


A wafer from the Plessey fab floor. Credit: Plessey Semiconductor.

On the surface, Hayes says, the acquisition would seem an unlikely move for a startup like Haylo. "Startups can come up with ideas and with concepts, develop a new recipe or a new formulation… There's no organization in the world, apart from Plessey, that can take raw materials and go through all the process—produce true end-to-end displays or product." This end-to-end control, he says, combined with a strong intellectual property portfolio, uniquely positions Plessey to lead the scaling of microLEDs from laboratory innovation to high-volume production.

Plessey's LEDs are made from GaN-on-Si (gallium nitride on silicon), enabling the creation of monolithic microLEDs with multiple emitters on a single chip, and multiple chips on 150, 200, and soon 300 mm wafers. The approach solves issues that have held back microLEDs from the mass market.

Hayes says Plessey is perfect for product design and development and has "north of seven or eight hundred million dollars' worth of tools in it, let alone the facility and the people. But it's not what you would call high-volume, low-cost manufacturing."



Plessey's red LEDs from their production line. Credit: Plessey Semiconductor.

Rather, it's a true semiconductor company, Hayes says, that's given Haylo the ability to do display development in the UK, as well as to create the processes and build the displays. Current capabilities for displays, optical interconnectors, or optical compute modules translate to in-house production capacity of some 20 to 30 million units per year. "And then over the next two to three years, be able to move the high-volume manufacturing into China. Bringing on a true partner that can do that under license is the perfect solution."

Three use categories

Hayes sees three use categories for Plessey's silicon photonics: "High-volume, mass-market adoption is going to be on wearable displays, volume manufacturing on optical interconnect, and sooner-than-blue-sky, definitely in the next five to seven years, true optical analog computing." He says Plessey will do the latter two in house as sensitive technologies that aren't leaving western customers. "But where we talk about the mass-market, high-volume products, having those manufactured for us under license in a custom-built fab in Asia."

He says the company's biggest challenge "is always going to be people and expansion. At any one time we have north of 100 open vacancies." While speed is one of their biggest advantages, with development time at sub-12 weeks, "nobody else can do that, but it's still very costly." Maybe the biggest challenge, Hayes says, is saying no to people. With the threat of being overwhelmed by customer requirements, it's crucial to pick the right opportunities that will actually lead to production rather than just doing development.

"To work with us is not cheap," Hayes continues. "It's an expensive process, which tends to mean we are enabling big companies, but at the same time we're continually investing in university spin outs [and] what people call microLED startups. It could be developing a new generation of GaN, it could be a lensing technology…. As a company we want to invest or license those types of technologies, we want to enable the ecosystem, but we want to enable that ecosystem through Plessey."

Asked about the value of the AR|VR|MR program at Photonics West, Hayes says the company seeks to balance futuristic development with product. "And to do that, there's a balance between having physicists and chemists that work for us, that develop this and who want to talk about that…." At Photonics West, he says, "all of our customers are going to be in one location. It's probably the only real kind of true coming together of all the right technical minds. It's a great opportunity for us to meet the right people."

WILLIAM G. SCHULZ

NKT Photonics engages with the industrialization of quantum systems

CEO Basil Garabet looks back on a decade at the helm of the Danish firm, and towards a key role industrializing quantum technologies with fiber-based systems.

NKT Photonics CEO Basil Garabet has been heading up the company since July 2015. Credit: NKT Photonics.

Show Daily: *You have now been heading up NKT Photonics for a decade: Can you compare the current operation with that from when you joined?*

Basil Garabet: I joined NKT Photonics in July 2015. At that time the mother company, NKT, had assembled a number of start-ups that they funded with Koheras and Crystal Fiber as a core along with LIOS and Vytran to form NKT Photonics. My task was to make sense of the companies and technologies that we possessed and to formulate a strategy for growth. NKT Photonics had a fantastic product and technology base that served many markets that needed to be guided to the next level of growth.

The management team at NKT Photonics was world-class and embarked on this journey with enthusiasm and purpose. We concentrated on markets where we were a clear leader, and embarked on a journey to capture many OEMs in these markets. The company in this journey grew five-fold and went from an OEM base of approximately 10% to today being over 80%. In this journey we also acquired Fianium in the UK and OneFive in Switzerland and sold both Vytran and LIOS as non-core businesses. The journey continues with being part of Hamamatsu, where we will see more great achievements.

NKT Photonics' Koheras Harmonik laser is designed specifically for trapping and cooling atoms in quantum applications. It offers everything needed for demanding quantum experiments, from cooling atoms to manipulating qubits. Credit: NKT Photonics.

Obviously the Hamamatsu deal was a big change: how has that change impacted NKT Photonics, and has the relationship developed as you hoped?

We have now been part of Hamamatsu for 18 months and we are working with the different manufacturing divisions on many synergies and improvements in the business. We have already seen and identified a number of projects like quantum where we are working closely with Japan and a number of internal supply opportunities that did not exist before the acquisition.

The decisions by the Danish Government to initially block and then allow the Hamamatsu deal seemed odd at the time: can you shed any light on what happened?

The deal between Hamamatsu was signed in June 2022. The first decision from the Danish Government in 2023 was a complete surprise and shock to us. We were not told the exact reason why this decision was made. This did not deter us or Hamamatsu and we worked closely with Hamamatsu to reapply, covering many aspects of this complex deal. The approval finally came in May 2024. These two years were some of the hardest for any management team to keep things together, but we managed to do so.

Quantum technology certainly seems to be a key area for NKT Photonics: how do you see the company's role in this emerging ecosystem and supply chain?

Quantum technologies are rapidly emerging worldwide, with significant progress in quantum computing driven by strong venture capital availability in the US—a resource that is less abundant in Europe. In this context, NKT Photonics positions itself in the role of a European-based enabler for quantum technologies, focusing on trapped-ion and neutral-atom quantum computers, advanced sensing systems, and optical clocks.

To support this ecosystem, NKT Photonics is scaling vertical integration to cover complete laser platform solutions, and solidify our role as an essential partner in the supply chain of our customers. Our approach spans the entire chain, from generating ultra-low-noise fiber-based light in our seed lasers, through amplification, frequency conversion, and light processing, all the way to light delivery via our proprietary photonic crystal fibers directly to the quantum processor.

In general, the current transition of the community from academic laboratory setups to industrial quantum computers introduces new requirements. Future systems will demand far more than photons of the correct wavelength; they will require integrated light modulation capabilities under a unified electronics and software control framework. Next to a significant scaling in power and module count, data center-like robustness and reliability will be key parameters to success. Only industrial-grade systems will allow the computer to run for many months uninterrupted between short service windows in data center environments.

NKT Photonics addresses these challenges with a robust, fiber-based system platform, guided by our philosophy that fiber optics enable the industrialization of quantum technologies. By acting as a trusted partner and technology enabler, we help ensure that Europe remains a strong hub for quantum innovation.

Can you outline what you have been working on in the partnership with IonQ?

NKT Photonics leverages its core strength in scaling innovation into industrial-grade products to support our customer's mission of building next-generation, data-center-scale quantum computers. Drawing on our multiple-decade-long experience in delivering into highly demanding sectors such as semiconductor manufacturing and medical devices, we provide a clear path to industrialization at a time when [our] customers' innovation process demands an impressive growth in module count and system complexity.

Quantum sensing is another key application area: what recent developments has NKT Photonics been involved in?

NKT Photonics is actively collaborating with leading quantum sensing companies across the EU, UK, and the US. We keep a strong focus on atom interferometric systems, which use precisely controlled laser

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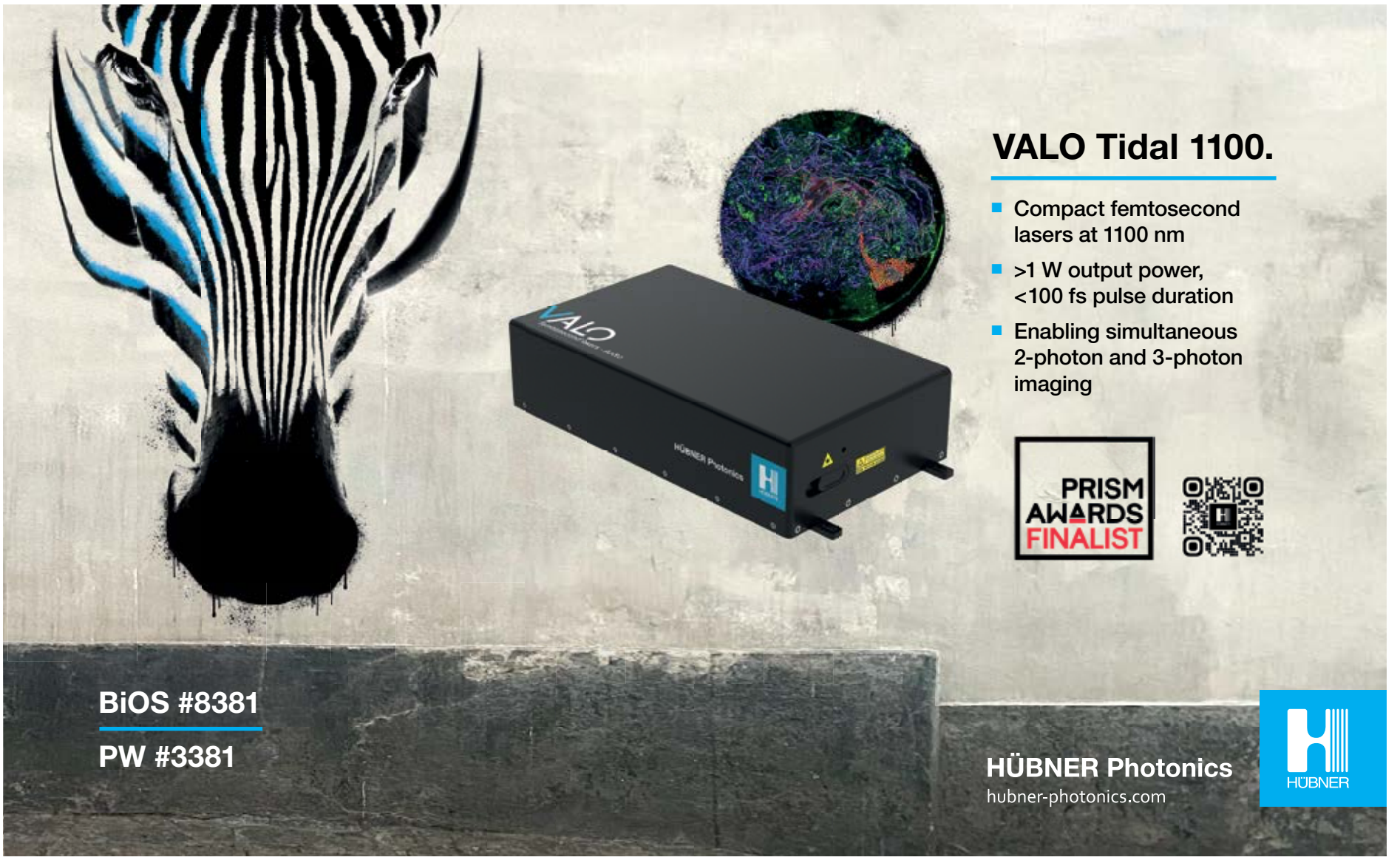

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Meta has unveiled the first consumer AR glasses. But what is next?

Today's booming AR technology market has been transformed since Google Glass was introduced in 2012.

Augmented reality (AR) has long looked for its ideal market. When Google first unveiled its Google Glass spectacles, the search engine-turned-device manufacturer touted the promise of bridging both the consumer and industrial markets—a promise never realized. Today, the AR market seems to have found its way with Meta reporting multimillion annual sales of the Meta Ray-Ban glasses.

Meta's contemporary approach is more complete, with more aspects considered from the outset, with fashion being uppermost. The collaboration with EssilorLuxottica and its portfolio of brands is playing a crucial role here. AI-based use cases, compatibility with existing ecosystems, and social acceptance are also key factors. Aesthetics are part of the acceptance equation, and, in addition, people are now familiar with taking selfies, while wearing connected devices in daily life has become normalized, making outward-facing cameras less unusual.

The Meta Ray-Ban glasses are therefore selling well and have not raised major privacy concerns. At the beginning of 2026, it can be accepted that Meta has primed the market with an audio-first solution, and that the next logical step would be to embed a display. We at Yole are confident that adding a visual interface will be a key factor for wider adoption. While the product is the glasses itself, much of the value proposition lies in accessing large-language-model-based services within a proprietary ecosystem.

The latest generation of Meta Ray-Ban—a series of AI glasses created by Meta Platforms and EssilorLuxottica. Described by its developers as "a stylish, colorful range of AI glasses with longer battery life and a higher-quality camera. With Meta AI, the wearer can capture life's moments, control music, take hands-free calls or translate conversations in real time—all without using a smartphone." Credit: Meta Platforms & EssilorLuxottica.

To use a metaphor, audio-only AI glasses are like using a computer through an interpreter who looks at the screen for you. It works, as current sales demonstrate, but with the growing variety of use cases and the need to cross the adoption chasm, this approach will likely soon reach its limits. Users need clear visual cues to understand which application they are using and how to interact with it. The promise of AI glasses is therefore closely linked to the transition toward AR glasses, which comes with a set of technological constraints that the industry is now addressing.

Reducing the 'niche product' risk

AR glasses risk remaining a niche product unless the form factor is reduced and battery life is significantly improved. The first generation of Meta Ray-Ban Display glasses sets a starting point at around 70 g and roughly one hour of live AI usage. A 20° field of view and approximately 40 pixels per degree are expected to remain typical of early commercial products, but other parameters will need to improve before wider adoption can occur.

One crucial area for improvement lies in the display engine itself. The first generation of Meta Ray-Ban Display relies on an LCoS-based display engine. LCoS is not a self-emissive technology and requires external red, green, and blue light sources. The integration of LEDs, the LCoS panel, optical elements, and interconnects results in a relatively bulky package. LCoS still offers some potential for size reduction through approaches such as photonic integrated circuits combined with LCoS, as investigated by Meta in recent R&D work (Shi et al., *Nature,* 2025).

Beyond LCoS, self-emissive technology could be a real game-changer. While the low brightness of OLED-on-Si (100k nits) is not compatible with the coming diffractive waveguide efficiencies and cannot deliver the right level of brightness to the eye, microLEDs can emit millions of nits, so thousands can reach the eyes.

Another factor that has changed since the Google Glass attempt is the rise of AI. AI does two things for AR: It provides a set of use cases that leverage the fact that the glasses see what one sees and hear what one hears, while releasing the constraints on the display system. Indeed, most of these use cases will be based on text and icons, so the number of pixels that are effectively lit can be low (usually below 10%), which favors self-emissive technologies.

Further work needed

For these reasons, MicroLED is considered the obvious go-to technology for 3rd or even 2nd generation of the tech giants' glasses, but some improvement is needed:

- RGB is mandatory to be adopted in the tech giants' products. However, current microLED-based RGB solutions rely on a three-panel approach using a prism as a combiner, whereas a monolithic (or single-panel architecture) would be better, as the advantage of a smaller form factor would be preserved.
- The EQE of the LEDs themselves can be improved further (particularly the red ones) as the pixel shrinks (4-micron pixel pitch seems to be the ultimate resolution with current approaches).
- The yield must also be improved to keep the increase in the cost of the display engine in the BOM from being much higher than 30%.

The most watched microLED attempt is currently the Google Raxium with its kind of hybrid between stacked and staggered RGB pixel approach, though there are many other contenders: Porotech with its Dynamic Pixel Tuning® proprietary technology, Aledia's nanowire, and Q-pixel to cite only a few (an exhaustive review can be

continued on page 27

Emily Cooper: Exploring human visual perception for better display technology and perhaps better eye health

The AR|VR|MR plenary speaker explains why understanding how our eyes see is vital to building better devices.

Understanding human visual perception—with a keen awareness of how that knowledge might impact display technology—is the focus of Emily Cooper's Perceptual Reality Lab at University of California, Berkeley. There, says the professor of optometry, "we try to develop insights into how people see the world, how they make use of complex visual information to infer what's in the world, and what they should do next. And then we take those basic insights about human vision, and we try to apply them to improve people's lives through visual technologies."

Emily Cooper. Credit: UC Berkeley.

Recent years have witnessed a focus on how to improve the quality of AR, VR, MR systems. Cooper says it remains challenging to have those systems look right as well as to be comfortable and usable. "We're interested in insights that will advance the technologies in general," she says. What's more, she says, her lab aims to develop insights that, in turn, can make those technologies more useful for people with a range of types of vision—from people with normal vision to people who live with conditions like retinitis pigmentosa or macular degeneration and might benefit from smart glasses or similar vision-enhancing technologies.

Cooper will be presenting *Focusing on color: How the eye chooses which wavelength to see best* in today's AR|VR|MR plenary session. What she will present is her exploration of a fascinating question: How do we achieve clear vision? This work was conducted in collaboration with an interdisciplinary team including then-postdoctoral research Benjamin Chin, who is now a professor at Rochester Institute of Technology.

As Cooper explains, when we look around at the world, our eyes move until they land on a point to focus. The lenses of the eyes then adjust to the right amount of optical power to bring that whatever-it-is into focus. "It's the teeny, tiniest of little eye movements," she says. "There's a little muscle inside your eye… it contracts and expands to allow your lens to achieve the right shape that brings that thing into focus."

While all of that may sound straightforward, "there's actually some basic properties of how we do that that are not well understood, and they have to do with color," she says. If one is looking at something like a brown telephone pole, she continues, it may indeed look brown but is actually reflecting a range of different visible wavelengths into the eye that the brain then interprets as brown. "Anytime you look at something that's colorful, your eye, your whole visual system has to pick only one [wavelength] to bring into focus, and the rest of the wavelengths are going to be out of focus."

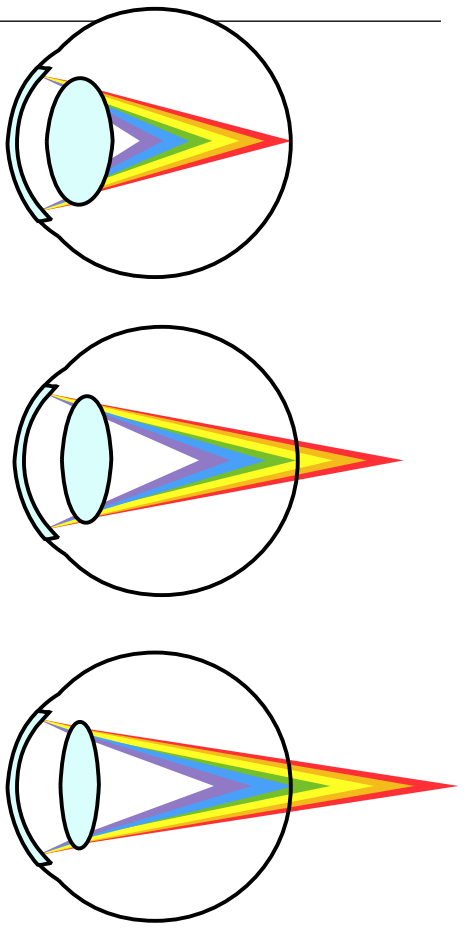
Considering the rainbow of choices for the eye, Cooper asks, which wavelength is "right"? How does that vary depending on what one might be looking at? A dive into the literature revealed little empirical evidence for how the eye chooses. What existed indicated that when people gaze at something that appears white, they focus on the middle wavelength—that is, 550 nm or green.

"But let's say you're looking at something that's red," Cooper continues. "Why would your eyes focus on green? That doesn't seem to be useful."

As luck would have it, though, Cooper's colleagues at UC Berkeley had built an optical apparatus that enabled her team to present people with a lot of different colors and stimuli and measure how their eyes focus changed. "So, we can answer this question of which wavelength people bring into focus when they look at something that's colorful," she says.

A Shack-Hartman wavefront sensor and many hours of people sitting in a dimly lit room reading words colored purple later and the answer is…? Well, Cooper and colleagues didn't find much to support the 550 nm idea. The eyes instead seem to be conducting a delicate wavelength balancing act. "Or results emphasize that the full color spectrum is taken into account in determining how the eye is going to focus," Cooper says.

Now, she says, her group has begun thinking about the relevance of what they found—how it might help people who are interested in developing better displays. "I often encounter people doing image quality modeling where they just assume that 550 is in focus. I think our data can improve those types of simulations. When you're creating an AR/VR display, you want to understand what the image is going to look like to the observer."



Different wavelengths of light behave differently inside our eyes. Credit: Emily Cooper and Benjamin Chin.

A flower with different wavelengths of light in focus. The flower image is modified from an image with the Pixabay license. Credit: Cooper.

Cooper hopes her group's investigation may have even wider impact when it comes to vision health. She points out that, for unknown reasons, an epidemic of myopia or nearsightedness not caused by genetics appears to be underway. While LASIK or a good pair of glasses might solve the immediate problem for an individual, in the long term, myopia, wherein the eye grows too long for the lens, is also correlated with higher risk for vision-threatening conditions like retinal detachment and macular degeneration.

Cooper—who is not an optometrist, rather a neuroscientist—notes that theories on the cause(s) of myopia include whether more wavelengths of light are being focused behind the retina, rather than the front, and this works as a signal for the eye to grow. "We hope that by providing data and a model to explain the wavelength that's brought into focus, our work might be able to support clinicians, researchers, designers, to think about how you could design a visual experience where fewer of the wavelengths are focused behind the retina and more of them are in front, potentially preventing harm."

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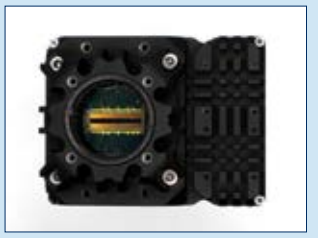

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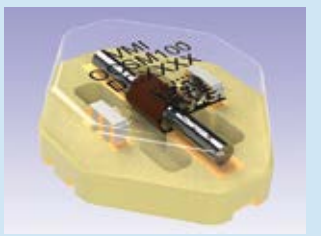

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Paul Heremans is chief technology officer at imec. Credit: imec.

Patrick Vandenameele (right) will replace Luc Van den hove as imec CEO in April 2026. Van den hove will take on the role of Chair of imec's Board of Directors. Credit: imec.

Toward the end of 2025, California data infrastructure firm Marvell Technology bought venture-backed photonic interconnect startup Celestial AI for a mighty $3.25 billion, sending its shares soaring by 13%. The move came as every connection point in the data center is moving from copper to optical to meet rising bandwidth demands. "[Together], we will enable customers to build AI systems that scale beyond the limits of copper and redefine what's possible in AI data center architecture," said Sandeep Bharathi, Marvell President, Data Center Group, at the time.

Firm foundation

imec was founded by the Flemish government in 1984, and has since built a remarkable R&D base that underpins much of Europe's semiconductor activities. Reported revenues reached €1.034 billion in 2024, and as a non-profit, imec reinvests these funds into its own research activities, which are vast—and growing.

imec currently has more than 6,500 researchers from over 100 different nations, and works closely with industry, including the materials and equipment suppliers from the semiconductor fabs it partners with as part of its programs. "From industry veterans to young PhDs and master's students, our diverse talent allows us to look at the technology challenges industry faces from many different angles," says Heremans. "And over the past four decades we've worked hard to develop trust with our industry partners and prove… our research."

Pockels breakthrough: Christian Haffner, scientific director at imec (below), and PhD researcher Andries Boelen have been growing thin films of strontium titanate on silicon wafers to boost the electro-optic response of SrTiO3. Credit: imec.

For Belgium-based imec—one of the world's largest independent semiconductor R&D organizations—the Celestial AI acquisition is testament to the research hub's expertise in recognizing and nurturing research talent. Celestial AI started out as an imec.xpand portfolio company—imec's venture capital fund—and had also partnered with imec's lab-to-fab service, IC-Link, that helps firms take chips from concept to commercial-grade silicon. As imec President and CEO Luc Van den hove said: "From concept to unicorn, Celestial AI's journey shows how imec is uniquely positioned to enable deep-tech ventures."

Celestial AI is just one example of how imec can provide start-ups with support—all the way from a university-linked open accelerator program to IC design, prototyping, and scalable manufacturing via its industrialization services. Paul Heremans, chief technology officer at imec, also highlights imec-supported holographic display start-up Swave Photonics which so far has won more than €40 million in venture capital funds from numerous industry players, including Samsung Ventures. "imec provides strategic investors with a first-look at the technologies that will give [these companies] a competitive edge," he says. "Likewise it offers financial investors the opportunity to benefit from being the first mover in a fast-developing market."

The diversity of imec's research is reflected in the numerous, wide-ranging talks the organization's scientists and engineers have presented at Photonics West. For example, Dmitry Kazakov, an R&D engineer developing silicon-integrated lasers, presented *Wafer-scale multiwavelength lasers on silicon*. Meanwhile, Oksana Shramkova, R&D project leader who investigates optical effects in photonic structures, had a presentation titled *Achromatic metagratings for single-layer waveguide near-eye display.* Topics covered in other presentations include external cavity lasers for lidar, wafer-scale photonic packaging, electrically-driven perovskite laser diodes for photonic integration, and wafer-scale manufacturing of wide-angle field of view metalenses.

imec researchers also delivered talks at this year's Quantum West conference. Scientific Director Christian Haffner and colleagues have been engineering strontium titanate to have a strong electro-optic response, or Pockels effect, at cryogenic temperatures, critical for emerging quantum photonics applications. Anja Ulrich, who focuses on nonlinear optical materials and novel electro-optic quantum transducers at imec, provided latest results in their presentations *Gigahertz Pockels-based strontium titanate modulator* and *Strong piezoelectricity in thin-film strontium titanate for cryogenic quantum transduction*.

Quantum-related presentations featured in Photonics West's industry events include *Toward large-scale quantum systems: Integrated photonics platforms for computing, communication, and sensing* from R&D project lead, Iakov Goldberg. Also, *Advancing SiN photonics: New functionalities, CMOS-compatible platforms for quantum and sensing applications,* from Senior Business Development Manager Amin Abbasi.

"Beyond our Photonics West presentations, we have also recently realized important progress in pushing the bandwidth of optical interconnects towards 400 Gbit/s per lane—key for next-generation pluggable optics and co-packaged optics," points out Heremans. "And we have reduced waveguide losses of silicon nitride wave guides to single dB/meter… as required for photonic-based quantum computing."

Research depth and breadth aside, these advances clearly could not take place without imec's ever-expanding infrastructure. imec launched its silicon photonics platform in 2013, which has been instrumental in driving optical interconnect development forward for high-performance compute systems. As Heremans highlights, an "elaborate" PDK now contains multiple passive and active components, including high-speed modulators and detectors. New materials and modules are also continuously added to the platform; examples include high-speed lithium niobate modulators, BaTiO3 phase shifters and switches, and III-V lasers and amplifiers. "The platform also leverages advanced 3D modules for EIC-PIC assembly with low parasitics and high density," he says.

To support work on quantum computing as well as all-optical computing, high-performance quantum sensing and other applications, imec is also building a platform for low-loss and visible photonics based on silicon nitride waveguides. The first version of the platform will be released later this year.

Pilot production

imec's pilot lines lie at the heart of its activities. In 2016, the organization launched its $1 billion-plus, 300 mm, beyond-7 nm cleanroom, to help users experiment with process flows and new materials in a realistic fab-like environment. However, its NanoIC pilot line—described as Europe's first beyond-2 nm system-on-a-chip pilot line—is now set to officially open in February 2026.

This 300-mm chip facility will support next-generation technologies, including optical interconnects, such as laser die-to-wafer integration on 300mm photonic interposers, as well as nanosheet transistors and spintronic memory. Partners include CEA-Leti, France, Fraunhofer of Germany, VTT, Finland, CSSNT, Romania, and Tyndall National Institute in Ireland.

"What sets the NanoIC pilot line apart is its open-access model for semiconductor technologies beyond the 2 nm node," highlights Heremans. "This pilot line taps into the EU Chips Act vision to accelerate innovation, drive economic growth, and strengthen Europe's semiconductor ecosystem… With this, we aim to establish a leading technology platform where European and international companies can explore new technologies before they are introduced into large-scale production."

Imec and TNO have launched the Holst Centre Photonics Lab, dedicated to integrated photonics R&D in the Netherlands. Credit: imec.

continued on page 19

imec continued from page 18

As part of the pilot line, pathfinding process design kits, P-PDKs, based on predictive models of future nodes and architectures will be provided to help designers develop next-generation chips and hardware. “The P-PDKs, as well as shared infrastructure and tailored training, enable even the smallest players to co-develop, experiment, prototype and scale next-generation chip solutions based on next-generation logic, memory and interconnect technologies,” says Heremans.

imec is also one of 20 partners in the PixEurope pilot line consortium that will develop and prototype photonic integrated circuit technologies for datacenters, AI, quantum computing, and more. Described as the world’s first fully-integrated PIC pilot line, and also deployed by the European Chips Act, the open access facility aims to bridge the gap between lab research and mass production, offering services for assembly, packaging, testing, and design. imec is set to contribute its expertise in heterogeneous integration, novel materials, and advanced packaging.

Collaboration is king

As the dust settles on the Marvell-Celestial AI acquisition, what is clear, is that imec’s R&D, infrastructure, and start-up support will be crucial to future photonics innovation. As Heremans puts it: “By providing a centralized, neutral place where we can do pre-competitive research, imec is able to look ahead and propose technology roadmaps to guide the industry toward future solutions.”

According to the CTO, imec will continue to invest in its photonics platforms, adding new components, increasing performance, and exploring new materials and devices. “For example, in the near future we may see new active devices added to our silicon nitride photonics platform, for use in neutral atom and/or ion quantum computing,” he says.

Heremans also reflects on the dizzying pace of AI algorithm development, which puts pressure on industry to swiftly innovate in AI hardware—yet while AI algorithms can change ‘overnight’, developing dedicated AI hardware takes a lot longer. “Running AI on suboptimal compute architectures leads to massive energy inefficiencies… There is also a high risk of stranded assets as the hardware may be outdated by the time it’s ready for the software,” he says.

“Research must now reinvent hardware innovation, prioritizing flexibility where silicon hardware becomes almost as “codable” as software, allowing components to be reconfigurable to meet shifting algorithm requirements.”

And of course, collaboration will remain key. In 2025 alone, imec agreed to establish an R&D hub in Qatar, inaugurated an innovation hub in Germany, and joined forces with the Netherlands’ applied science organization, TNO, to launch the Holst Centre Photonics Lab at High Tech Campus Eindhoven. Other partnerships included MIT Labs, Zeiss, Tokyo Electron, ASML, Merck, and Openchip—and undoubtedly more will follow.

With an eye on global collaboration, imec has agreed to establish an R&D hub in Qatar, supported by the Qatar government. Credit: imec.

Pointing to rapidly-changing geopolitics, Heremans concludes: “The semiconductor industry is a global ecosystem that leans heavily on collaboration. While each region has its own strengths, we must collaborate with the best of the best in the entire ecosystem to continue innovation and tackle the technological challenges.”

REBECCA POOL

Targeting anti-microbial resistance by integrating spectroscopy with AI

Show Daily interviews Vincent "Chuck" Mattera, former CEO of Coherent who now leads startup HyperSpectral, developing the world's first 'spectral intelligence platform.'

High-resolution photo of MRSA bacteria. Credit: HyperSpectral/Shutterstock.

Show Daily: *What is the background to HyperSpectral and its technology?*
Chuck Mattera: Founded in 2022 and awarded the 2025 SPIE Prism Award in the Software category, HyperSpectral is building the world's first Spectral Intelligence Platform—an AI-native system that reveals the chemical, biological, and material truth of the world in real time. By fusing multimodal spectroscopy with physical science models guided by machine learning and advanced AI, we transform photons into actionable insight. Our technology enables machines to sense what the human eye cannot: molecular composition, purity, authenticity, stress signatures, and environmental change.

Vincent "Chuck" Mattera, CEO of Avalanche Thinking Inc, and Board Chair of HyperSpectral. Credit: HyperSpectral.

We make the physical world machine-readable. From industrial manufacturing process control to biopharmaceuticals, agriculture, defense, and medical diagnostics, HyperSpectral delivers a new category of capability: AI that sees the unseen.

How will the software function and what are the target applications and markets?
Our platform aims to provide instant classification, detection, and prediction of materials and biological states, ultimately to empower scientists and scientific instruments to understand and act on spectral data. Where other AI models learn from the internet, ours learn from the physical world itself, generating proprietary spectral signatures and continuously improving through real-world deployment and the cumulative learning from data and insights.

HyperSpectral is creating the foundational sensing technology for the next era of autonomous systems and advanced manufacturing. Our platform aims to transform the physical world into structured, machine-readable information, enabling rapid and precise classification and detection in massive and underpenetrated markets.

What are the links between photonics and AI and the developments by HyperSpectral?
Spectroscopy and optics are the physical foundations on which HyperSpectral's Machine Learning and AI data platform is being built. To be here, sharing that we've cracked the code on how to take what has always been known as atomically precise spectroscopic data and make it even more useable, feels like a celebratory turning point for the entire field. AI systems today largely operate on text, images, and historical datasets. But the next frontier—from robotics to biomanufacturing to industrial automation—will depend on AI that can understand the real world at the molecular level. HyperSpectral is positioned to become a category leader in this market shift. Our vision is to become the indispensable intelligence layer for every autonomous machine and industrial system, revealing the chemical and biological truth of the world in real time. HyperSpectral is not just improving sensing, we are creating the data and intelligence infrastructure for the next technological waves.

Can you share any recent updates from HyperSpectral coming out of Series A?
HyperSpectral is at an exciting inflection point. The company's proprietary AI was trained to decode complex, multi-modal spectroscopic datasets. Our software, SpecAITM, is now active in projects involving bioreactor manufacturers, bacterial infection diagnostics, and major healthcare systems just to name a few. We're seeing an overwhelming interest in this kind of real-time intelligence about the physical world, and we are now working to scale and commercialize to meet that forecasted demand.

What are the company's future plans and ambitions?
As SpecAITM continues to mature and is working to drive wider adoption, HyperSpectral's long-term roadmap anticipates layering in multi-sensory inputs beyond spectroscopy—acoustic, material, electrochemical—to achieve the first-ever real-time sensory intelligence platform. Because this platform is hardware-agnostic, it can be used in any domain. The company's founders bring deep domain experience developing commercial software. We envision a day where anyone can access this platform to quickly learn about their environment. But today, we're grounded in the immediate use cases before us, particularly those that present real opportunities to help humans quickly make the best decisions to drive scientific discovery, support users in the field, and provide real-time manufacturing process control.

A notable target market is countering the threat of bacteria and the growing problem of their resistance to countermeasures.

Can you expand on this.
One of the company's core focal points is Anti-Microbial Resistance (AMR), because not only do immensely rich data sets exist in this space, but more importantly, there is a real opportunity to save lives with faster, cheaper, repeatable diagnostics. In 2023, researchers with the Global Research on Antimicrobial Resistance Project published a study projecting that if preventative measures aren't taken, by 2050 AMR will exceed cancer in its toll on human lives. Thanks to the integration of advanced AI and spectroscopy, we now have a tool that will shorten the cycle time to address and mitigate infection. Already, the platform is creating a bacterial ID library and is actively collaborating with health and research systems across the globe to expand it. That's just one of the many areas where HyperSpectral can deliver detailed and rapid insights for humans to act upon when it matters most. Process Analytical Technology in manufacturing is another important area for this kind of platform to deliver rapid, reliable, actionable data that can revolutionize how we monitor, understand and control the physical world.

How important are HyperSpectral's relationships with research and academic institutions? What are the company's current and planned data inputs?
Fundamentally, this platform was created to unlock the mechanisms of science—to drive process understanding. For that reason, engaging the scientific and academic communities is paramount, as is the relationship with users in life-science diagnostics and discovery, and advanced manufacturing. Much of the last year has been focused on building those partnerships and pipelines. The platform is built on both proprietary and open-source data. With every use, the data is enriched, making results more accurate and valuable over time. While in principle, it can integrate data from any sensor, we're currently focused on spaces where rich data already exists and where we can have a material impact on discovery for the benefit of scientific and technical knowledge.

What are likely developments, opportunities, and emerging markets for HyperSpectral given the ever-changing technological, economic, and geopolitical landscapes?
Particularly with the advent of the "AI scientist," there are numerous emerging markets and opportunities for this kind of real-time sensory intelligence. We know that AI can minimize the time it takes to interpret the physical world. We know that immensely rich datasets exist that have yet to be fully decoded and utilized. And we believe that our platform can unlock valuable insights. We are seizing a critical moment to drive AI for discovery forward, made possible right now by cost-effective, standardized hardware and low-cost and powerful cloud computing. The need for this kind of real-time intelligence about our world will always exist, and HyperSpectral intends to serve it.

What is it like to be back at Photonics West in your new role, having previously been a participant, exhibitor from II-VI Inc and Coherent Corp, and, now Avalanche Thinking?
Few conferences capture the expanding arc of our industry in the way that Photonics West does, from fundamental materials and device-enabling components to breakthrough systems that are reshaping global infrastructure in computing, communications, sensing, manufacturing, defense and space, and bio tech. Much more than simply a technical conference, it is a chance to engage directly with the innovators from diverse fields. With AI and quantum computing rapidly becoming important realities, I am eager to connect with long-time colleagues, meet new potential collaborators, and learn from the staggering breakthroughs happening across the various ecosystems. I am genuinely excited to participate again this year as CEO of Avalanche Thinking, as a Distinguished Fellow of the World Economic Forum focused on advanced manufacturing and supply chains, and especially as Board Chair at HyperSpectral. What a great way to kick off '26!

MATTHEW PEACH

AR Alliance joins with SPIE to co-develop augmented reality

Show Daily interviews Bharath Rajagopalan, Chair of the AR Alliance, about new partnership and 'progressing the AR hardware ecosystem.'

Bharath Rajagopalan, Chair of the AR Alliance. Credit: AR Alliance.

The AR Alliance (thearalliance.org), a member organization dedicated to advancing open and interoperable augmented reality (AR) ecosystems and supply chains, was re-established in November 2025 as a division of SPIE, the international society for optics and photonics. The AR Alliance provides a supportive and neutral environment for organizations of all sizes to take an active role in advancing and strengthening the augmented reality hardware development ecosystem. Diverse organizations across the expanding, global AR ecosystem, work together through the AR Alliance to speed innovation and breakthrough technologies and processes for building AR wearables and devices that create meaningful and positive experiences for users.

Show Daily: *What has been the background to the formation of the AR Alliance?*

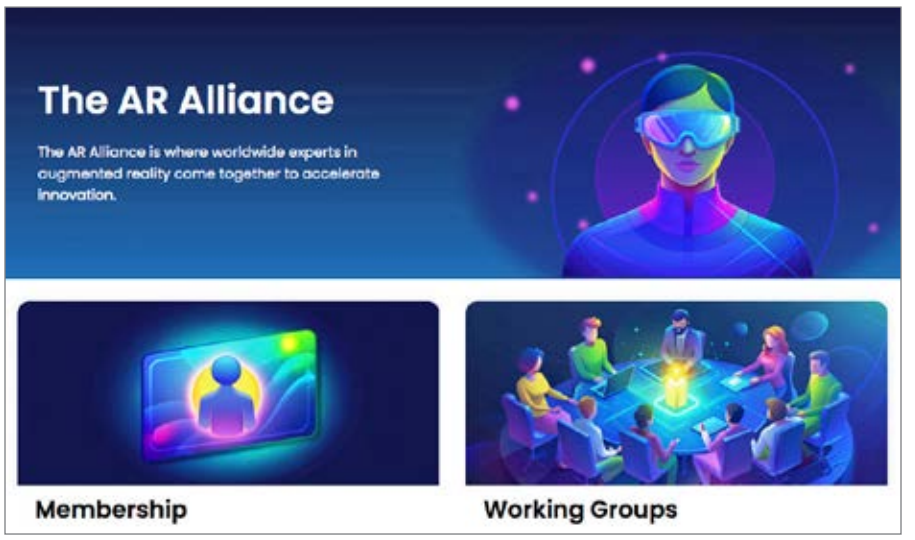
Bharath Rajagopalan: The AR Alliance was an evolution of the LaSAR Alliance (Laser Scanning for AR) which had a specific objective that was met—namely, the promotion and promulgation of laser scanning-based technologies for AR. The transformation into the AR Alliance took place in October 2023 to address the broad needs of the AR market and to serve a diverse range of companies across the expanding global AR supply chain. The AR Alliance was established to provide a unified, balanced voice across this rapidly evolving ecosystem by facilitating open innovation among the members and evangelizing AR advancements to marketplace at large. It also serves as a voice for the industry through influencing and shaping the emerging and developing standards and regulatory requirements.

Which types of organizations are in the AR Alliance?

There are currently nearly 30 member companies and it is rapidly growing. The companies range in size from large, technology leaders to small and innovative start-up companies and everything in between. The disciplines range from displays, optics and photonics, to materials, metrology, and manufacturing, as well as algorithms and systems.

positive experience for users. We also provide a united voice in influencing and shaping AR regulatory requirements and the industry's development of standards. Our goal is to play a pivotal role in the creation and growth of a thriving AR marketplace.

What is encouraged, and is also a key benefit of membership is for each member to play an active and participatory role in the organization through joining one or more of the working groups, via engaging in webinars, developing white papers and other activities within the organization.



Taking an active role in advancing the augmented reality hardware development ecosystem. Credit: AR Alliance.

The objective of the AR Alliance is to foster collaboration among companies in the AR ecosystem worldwide to speed innovation of breakthrough technologies and processes for building AR wearables and devices that create meaningful and

What are the photonics-related technologies and applications?

Photonics and optics are fundamental to AR applications. The display technology, relay and combiner optics are foundational to see-through AR devices. Overall, it is the broad spectrum of hardware and software technologies enabling AR wearable devices including displays, optics, photonics, the associated materials, manufacturing and metrology technologies, and systems and software that unifies the various architectures.

What is your view of the current market situation and likely developments in 2026?

The current market situation for AR is very favorable with the introduction and proliferation of audio-only, smart glasses that was popularized by the Meta Ray-Ban smart glasses. This development has introduced the idea and notion of AR to general consumers through a familiar device (glasses) and application (music and photography). With the recent announcement of the addition of a simple display to these glasses, we believe that the market for mass adoption of AR smart glasses, including the see-through display, has been enabled. However, what can be a game-changer is the rapid advancement of AI which enables a greater range of applications and use cases for AR.

These "informatic" display AR smart glasses will likely see broader adoption in the coming years. As consumers generally get more awareness of AR smart glasses and more people use these devices, and as technologies continue to advance on

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MKS ‘at the center of AI-driven industry transformation,’ says CEO John T.C. Lee

Show Daily interviews head of tech firm that spans the photonics supply chain.

John T.C. Lee, CEO of MKS Inc. Credit: MKS.

Show Daily: *Give an outline of recent developments at MKS and important company news*

John T.C. Lee: MKS continues to perform strongly, both operationally and financially, which is enabling us to deliver solid value to our shareholders. At the same time, we’re pushing the frontier of technological innovation to maintain that position going forward.

Recent notable achievements in several of our key markets include:

- Our technologies now power more than 85% of wafer fabrication equipment applications and are utilized in approximately 70% of the critical steps in package substrate and PCB manufacturing. MKS is involved in technologies ranging from lasers, optics, vacuum, and plasma power to chemistry and process control.
- Key investments we have made in semiconductor and advanced electronics manufacturing also enable us to address other markets, including industrial, life and health sciences, defense, and research. The solutions and expertise we’ve developed for our core focus enable us to deliver differentiated products and value to these other sectors.

Artificial intelligence is reshaping how the world processes information. Behind every AI-driven device is an intricate network of high-performance PCBs, advanced substrates, and precision manufacturing technologies. We are at the center of this transformation, offering the broadest and most diverse product portfolios targeting nearly every aspect of the fabrication process. We call this comprehensive approach, “Surround the Workpiece®.”

In addition to AI, MKS is benefiting from the trends toward miniaturization and increased complexity in other areas of advanced electronics. This requires denser interconnects, finer features, new materials, thermal management, and energy efficiency. Most of our technologies—lasers, optics, precision motion, vibration control, chemistry—support and enable this trend.

Financially, our most recent quarterly results show that we achieved revenues as well as Non-GAAP EPS in the upper half of our guidance. Our investments to expand our portfolio over the past several years are paying off, with both our semiconductor and electronics and packaging businesses poised to deliver double-digit revenue growth in 2025.

What are the company’s significant achievements since 2020 and development plans?

MKS has achieved several significant milestones since 2020, positioning itself for continued leadership in the semiconductor and advanced packaging sectors. The most prominent strategic achievement was the transformational acquisition of Atotech in 2022, a leading process chemicals technology and equipment provider for advanced surface treatment. This broadened MKS’ addressable markets, particularly in advanced packaging, PCBs, and general industrial surface finishing.

During that period, MKS also strengthened its market position in key areas including power solutions, vacuum, and photonics. All these are essential to leading-edge semiconductor manufacturing.

The company has also continued its strong track record of working closely with customers to help them meet their most daunting challenges through state-of-the-art innovation and products. Ongoing R&D investments led to new product introductions including new power delivery systems, gas delivery solutions, and optical components. Further to that, we are focused on lowering our leverage.

Worldwide locations and associated activities?

With more than 10,000 employees worldwide, MKS has a major presence in North America, Europe, and Asia. In recent years, we have been investing significantly to expand our presence in Asia. This includes:

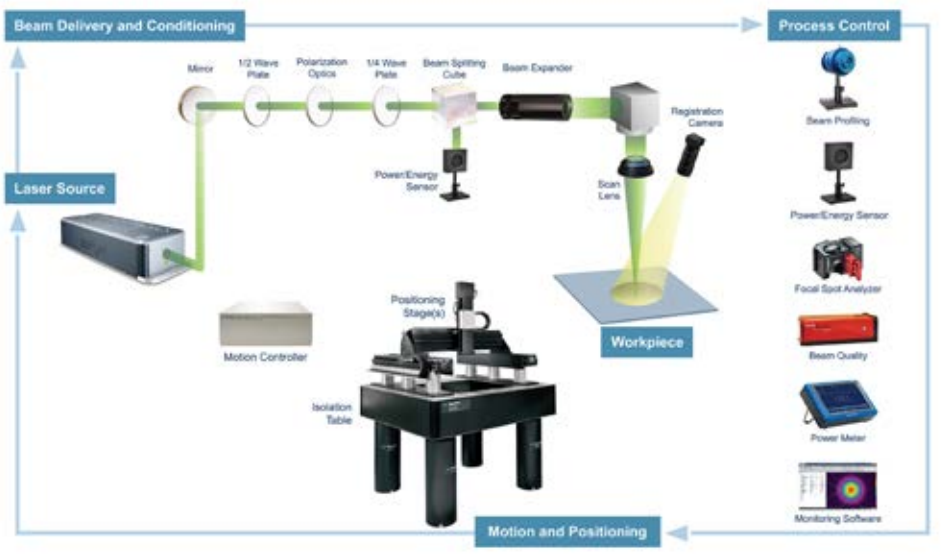
- Penang, Malaysia: A new Super Center for wafer fabrication equipment (under construction since 2024).
- Flagship expansion in Thailand: Broke ground in May 2025 on a US$40+ million MKS chemical manufacturing facility and TechCenter near Bangkok that will be operational in the second half of 2027, with annual capacity of 18,500 tons.
- Expansion in Bucharest, Romania: Upgrade and expansion of our facility focused on Photonics Solutions products.

What is the 2026 message from the company for Photonics West?

For 2026, our message is clear: we are delivering the core science and engineering that underpin the future of electronics, and we offer a broad and diverse portfolio that empowers customers to solve the toughest challenges in device manufacturing. We continue to invest in innovation and global expansion to maintain this position. And we engage in collaborative partnerships to give our customers a competitive edge in their own rapidly evolving landscapes.

Visitors to Photonics West 2026 can expect to see new product introductions and enhancements across our photonics-focused brands, including:

- Ophir: Advanced laser measurement and beam profiling solutions that support the need for increasing precision in industrial, medical, and research applications.
- Spectra-Physics: Lasers that deliver the combination of output characteristics, reliability and cost-of-ownership required for success in precision manufacturing, life sciences, and quantum technology.
- Newport: Innovative optical components and motion control systems supporting cutting-edge research and manufacturing.



MKS’s Surround the Workpiece® strategy delivers end-to-end photonics solutions, from innovative product design and integration, to maintenance and calibration. Credit: MKS.

What is the company’s involvement with industry associations, such as SPIE?

MKS has always viewed industry associations, and especially SPIE, as critical to the current and future health of the photonics business. We support and participate in SPIE events, contribute to technical conferences, and collaborate on initiatives that advance photonics research and education. Our involvement reflects our commitment to driving industry progress, fostering innovation, and supporting the broader photonics ecosystem through active engagement and thought leadership.

In the company’s view, what is the state of its photonics-related markets and likely developments for 2026?

Many diverse markets—including semiconductor manufacturing, electronics packaging, medical device manufacturing, aerospace, biomedical research, and quantum computing—all share a common underlying trend towards miniaturization, higher device complexity, improved reliability, reduced energy usage, and lower costs. Photonics supports all these goals more effectively than any other technology, and we expect this to fuel strong demand and growth in 2026.

In addition to the AI-fueled growth in business, which is obvious to everyone, we also anticipate expansion in areas such as infrared imaging for defense and in biophotonics for healthcare. Companies with broad technology portfolios and a focus on innovation are likely to benefit most from these evolving opportunities.

Changing economic conditions and geopolitical factors, such as tariffs and supply chain disruptions, have created both challenges and opportunities for all businesses. At MKS, our focus on technical leadership in key product categories, together with well-differentiated products that offer superior value, will support our continued growth. Overall, MKS remains agile and optimistic, prepared to adapt to evolving market dynamics and capitalize on emerging opportunities.

MATTHEW PEACH

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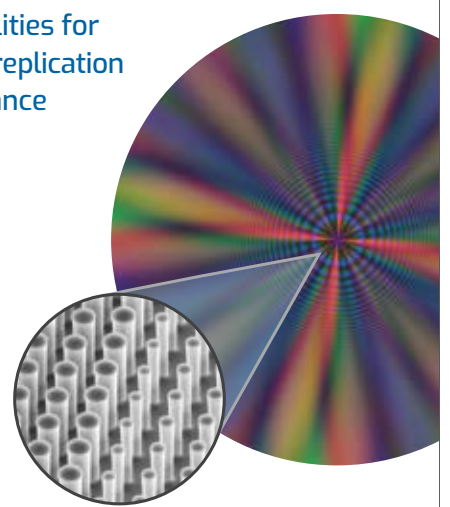

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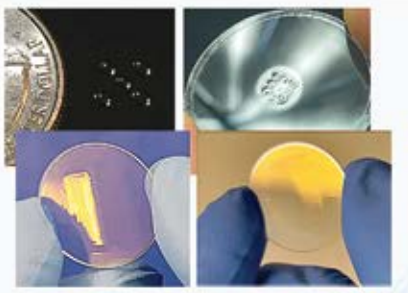

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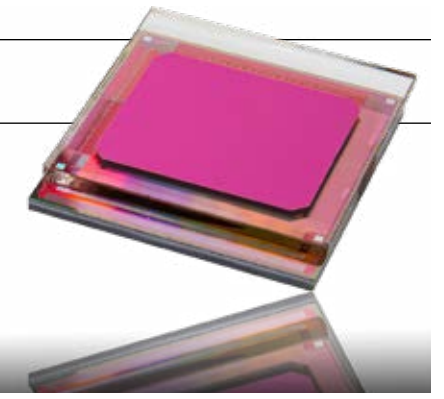
Programmable beam scanning meets the needs of a dynamic world

Lumotive's Apurva Jain explains how the company aims to take its place as "the NVIDIA of optics."



Breakthrough: the Light Control Metasurface chip. Credit: Lumotive.

Traditional bulky optical devices, with their fixed components and mechanical methods of beam steering, are a poor match for the needs of modern robotics and the growth of AI-driven automation. New approaches with fewer constraints on speed, reliability and scalability are needed, so that these systems can operate at their full potential.

That's the view of Lumotive, the Redmond, WA-based developer of programmable optical semiconductor chips able to steer and direct light without the need for mechanical moving parts.

Lumotive's SVP Apurva Jain. Credit: Lumotive.

"Our programmable optical components represent a big shift in how optics platforms can be constructed and what they can do," said Lumotive Senior Vice President Apurva Jain.

"This is now an enabling technology, as the world incorporates AI more deeply into an increasing variety of systems, equipment, and machines. Automation is everything in this new model, and data flows must become faster and more reliable. There is no way to do this except with light, through optics."

Lumotive's breakthrough is the Light Control Metasurface (LCM) chip, in which functional metasurfaces can shape and direct optical energy in any direction. In the company's proprietary design, voltage-controlled liquid crystal positioned within the optical fields of the metasurface nanoantennae alters how those antennae redirect incident light, and can do so in a variety of different ways.

This redirection can be controlled further through the arrangement of the controllable nanostructures themselves in different formations. The Lumotive LCM chip can carry out one- and two-dimensional steering as well as spatial beam shaping, through judicious application of these different effects.

"This technology is able to control light with software and no moving parts at all," said Jain. "It can make optical systems very small and compact, as well as adaptive. This flexibility is key when it comes to physical AI, the intelligent systems that let real-world autonomous platforms perceive the physical world around them and react accordingly."

LCM technology and CMOS manufacturing

Metasurface technology and the principles behind subwavelength structures manipulating incident light are well established, but Lumotive understood that integration with existing semiconductor manufacturing processes was vital to bringing its LCM chips to market.

"Our key innovation was bringing together LCM technology and CMOS manufacturing," Jain commented. "The way to make the technology both low-cost and scalable is to manufacture it in a traditional CMOS foundry process, and then package it using well-established liquid crystal on silicon LCOS principles. The structured metasurface design was a major breakthrough, but the ability to efficiently produce it on CMOS manufacturing platforms was just as significant, and has been a major element in progressing Lumotive LCM chips from R&D project to commercialization."

The CMOS approach also allows Lumotive to assume a role as a semiconductor company—a chip provider, rather than a pure optics vendor. It is positioning itself as a developer of technology that allows optical platforms to become both flexible and updatable, capable of "seeing" for themselves.

"We think of ourselves as the NVIDIA of optics," said Jain. "We are a chip provider, feeding a portfolio of different optical chips into many different applications. NVIDIA has a core chip technology, which is then sold to different sectors, into cars and robots and data centers, and we see Lumotive in an analogous position. This means, as a semiconductor company, we are able to support multiple markets."

An example of Lumotive's targets is the lidar sector. LCM chips can replace the mechanical mirrors in a lidar platform, steering the light electronically in programmable patterns while also saving energy. The technology can allow flat optical designs with no wasted space in which the lidar laser beam is both directed and expanded, combining lensing and steering operations in one functional component.

Another focus is 3D sensing for robotics and industrial automation. Lumotive CEO Sam Heidari is addressing the SPIE Photonics West Vision Tech Forum on this topic, describing how LCM-based vision systems can overcome mechanical and fixed-optics limitations in robotic vision, along with lessons developers can learn from large-scale deployments driving the next wave of intelligent automation.

"Lumotive LCM chips allow both the power consumption and complexity of an autonomous robotic system to be reduced," confirmed Jain. "In combination with AI, the sensors can become better at their tasks over time. They can learn where to focus the light, where to expand the beam, and improve their efficiency at the tasks they are designed to do. This ability could be applied in many different robotic applications: indoor and outdoor equipment, autonomous parking, robo taxis, drones, smart buildings, and others."

Lumotive's ambitions have been supported by its most recent funding round, $45 million in Series B financing raised in February 2025. When the round closed, Lumotive indicated that the funds would be directed towards three goals: global market expansion to meet growing demand from customers and partners in critical industries; next-generation optical semiconductors specifically for defense and aerospace applications; and support of data center AI infrastructure, as the company seeks to reshape data center architecture.

Macroeconomic headwinds are now a fact of life for all international photonics developers, but Jain pointed out that the Series B funding round was oversubscribed, a good sign for the company. He believes that Lumotive is now well placed to prosper, whatever turns the global economic situation takes.

One of Lumotive's target markets is the lidar sector. Credit: Lumotive.

Moving from electrons to photons

"It is a great time to be an optical semiconductor company in the United States, with optics technology moving into a large number of sectors and applications, and with data centers now moving to optical switching too," he commented. "Lumotive was founded in 2017, and as with any young company we naturally needed not just great technology, but also to be in the right financial environment and economic trend cycles. For us, these factors are working out well."

Photonics is very much a global business, however, with international supply chains a fact of daily life alongside unpredictable macroeconomic changes. Lumotive has taken the necessary steps to be securely multisourced on every aspect of its operations, including its CMOS foundry and packaging requirements.

"At present there is a big effort to have US companies onshore their semiconductor technology, and we think we can play a part in that," said Jain. "But we are a global operation, and address global markets. We have customers in North America, Europe, and are now expanding in Asia. Alongside our HQ in Seattle and office in the Bay Area, we have an office in Vancouver, Canada, and Muscat, Oman. We are hiring across the board."

That recruitment effort is one element in Lumotive's participation at SPIE Photonics West, where this year the company has expanded its booth on the exhibition floor. It will be demonstrating the LCM technology as an optical element and built into demos of lidar systems and robotics. There will also be an early concept of the optical switch application for datacenters that Lumotive anticipates becoming a significant business sector.

"Photonics West is a chance for Lumotive to engage with the optics community, as well as current and future customers," said Jain. "It is a broad optics show, and, as well as getting to hear what those customers need, we can present Lumotive technology and show what programmable optics can do for robotics, networking, and other applications. This is all about the move from electrons to photons across multiple industries, and we provide the building blocks for that."

TIM HAYES

Meta AR glasses continued from page 13

found in our MicroLED 2025: Technology, Equipment and Manufacturing report).

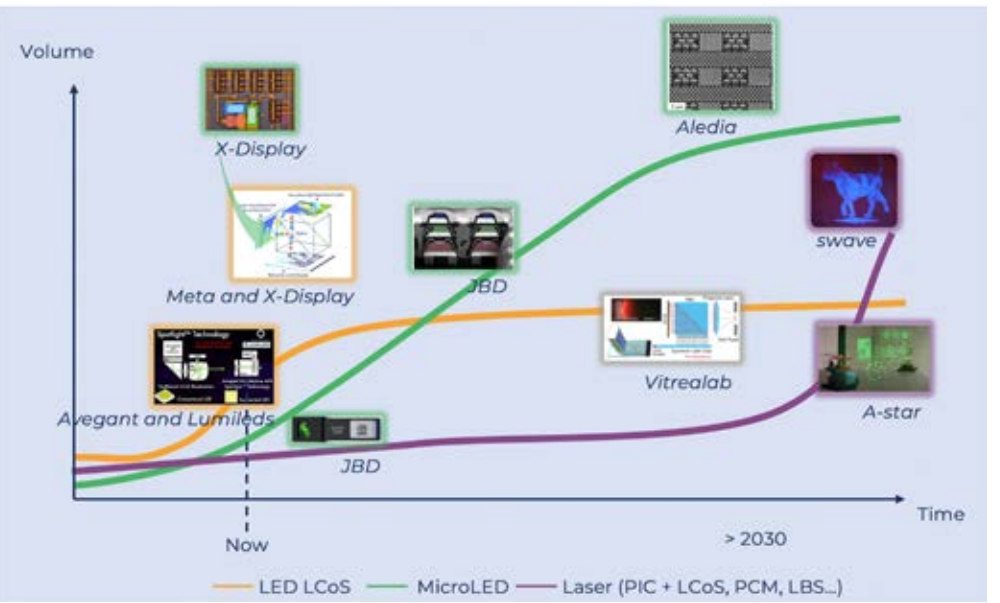
Regarding Google's broader AR strategy, the company has been building a more complete ecosystem following the Raxium acquisition. It appears to be collaborating closely with Magic Leap, Samsung, and Qualcomm, following the consortium announced in 2023. Google also recently acquired AdHawk, a company specializing in MEMS-based eye-tracking technology.

Meta's strategy, as an ecosystem owner, appears different. The company may favor more off-the-shelf solutions rather than deep vertical integration, as suggested by recent supply-chain moves such as Goertek's acquisition of Plessey.

Google and Meta are currently the two main AR front-runners in Western markets. Broader adoption of AR, however, is likely to depend on additional consumer-electronics players entering the market. This will become more realistic as component costs decrease, particularly for display engines, optics, and sensing modules. Our current hypothesis is that large consumer-electronics players could realistically enter the AR glasses market around 2028.

A different picture in China

The situation in China is quite different, with a highly diversified competitive landscape. A notable characteristic of the Chinese market is the success of birdbath-based architectures, with companies such as Xreal demonstrating market traction at close to one million units per year. More recently, most Chinese players have been shifting toward MicroLED-based solutions and diffractive waveguides, even when displays remain monochromatic or rely on three-panel architectures, such as the TCL RayNeo X3 Pro using a JBD prism-based display engine.



Screen stars: A roadmap for augmented reality display engines, according to analyst Yole. Source: AR/VR 2026 From Optics Displays to Advanced Sensing and Processing, a report by Yole. Group.

Overall, Yole Group projects a total market of around 40 million units per year by 2031 for smart eyewear and AR glasses combined. Of these, approximately 35 million units are expected to include a display, with around 30 million targeting mid- to high-end segments using RGB displays. Market segmentation will occur both in terms of color capability, with entry-level products relying on monochromatic displays, and in terms of field of view. While resolution is expected to remain in the 30-40 pixels-per-degree range, the field of view is likely to span from around 20° at the low end to 40° for higher-end products.

Another segmentation could be observed in the display engine type: LEDs with a fixed distance virtual head-up display, or leveraging coherent laser light to play with the phase and enable volumetric AR. Such attempts, like Swave's or A-star's, could pave the way towards vergence-accommodation conflict solving and a more immersive experience.

RAPHAËL MERMET-LYAUDOZ

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Coping with China's restrictions on critical materials exports

Measures have included finding alternative sources of germanium, gallium, and antimony, and in at least one case, deploying an inventive replacement.

Germanium lens assemblies from Omega Optical. Credit: Omega Optical.

The last several years have been challenging ones for optics companies that rely on "critical materials," which they had been accustomed to buying from China.

Specifically, China has, since 2023, imposed a shifting set of bans and restrictions on its export of germanium, gallium, and antimony, all of which have long played a vital role in the manufacture of optical systems. Likewise, China continues with a long-running regime of on-again, off-again rare earth export rules.

Omega Optical CEO David Cooper at the company's large format coatings facility in Ithaca, NY. Credit: Omega Optical.

To get a sense of how the industry is coping, *Show Daily* spoke to three different companies, two related to germanium use, and one that relies on rare earths.

Germanium is a star performer in the optics industry. It does an excellent job of bending light—to talk the talk, it has a high refractive index of around 4.0. But it does this in the infrared spectrum, not with visible light. Thus, it is commonly used in infrared imaging systems as a thin-film coating for lenses, prisms, windows, and other gear. It's a top choice for makers of equipment such as night vision cameras and detectors. It is widely deployed in military applications, but also outside of the military for things such as infrared spectroscopy in the life sciences and material sciences, among others.

But in July 2023, China began requiring licenses for germanium exports, a move that became an outright ban in December 2024. In November 2025 China suspended the ban, but again imposed a bureaucratic process for either approving or declining exports on a case-by-case basis.

Omega Optical (booth #649) in Brattleboro, VT, is one company that has found its way around the Chinese situation. Omega designs and manufactures precision optical filters, coatings, diffractive optics, and infrared components for customers in a wide range of industries including aerospace, defense, life sciences, environmental monitoring, semiconductor, and more.

"Prior to two years ago, a large percentage of the global supply base for germanium came out of China," says Omega CEO David Cooper. Then, the restrictions started, "and caused Omega Optical and others like us in the marketplace to have to find alternative supply sources for germanium," he adds.

Alternative sources

Fortunately for Omega, the company had already established other sources of germanium in the US and Europe, so the flow of germanium did not stop. But it certainly tightened.

"There are high quality and high reliability alternatives with whom Omega had previously established robust supply chains, but none of the scale that you could get out of China," says Cooper.

That, in turn, has rocked the value chain in predictable ways.

"Over the last two years it's caused a considerable impact on the global supply chain for germanium, both from an availability standpoint, from a lead time standpoint, and, for our customers, a cost standpoint," says Cooper. "The cost of sourcing germanium from alternative supply sources follows the traditional supply and demand equation, and there was temporarily more demand than there was supply, so prices increased dramatically over the last two years."

The good news is that Omega is still getting germanium and building its products. But it is paying plenty more, and is waiting longer too. Omega's customers subsequently feel the same rub.

So has China's late-November 2025 easing of restrictions helped?

"It is still early, and the situation continues to unfold, but to date, I would say minimally," Cooper replies.

Although China did lift the outright ban on germanium exports, it attached significant bureaucratic strings. Buyers like Omega must submit documents to Chinese vendors stating the purpose for their purchase. The vendor then sends those forms to government officials, who either approve or decline the sale. Military use of exported germanium is not allowed.

Cooper describes the Chinese review process as "still slower than it was two years ago," and says Omega continues sourcing germanium primarily from its US and European alternatives.

One US germanium supplier earlier this month announced plans to ratchet up its output of germanium and other products. Lattice Materials (booth #2043) of Bozeman, MT, said it will break ground this spring on an 80,000 square-foot facility, doubling the site's current footprint. The expansion will be partially funded with $18.5 million from the US Department of Defense.

Glassy eyed

While Omega and other infrared optics companies continue to tap alternative germanium sources, one vertically integrated thermal and optical imaging company—Florida's LightPath Technologies (booth #3411)—is taking another approach across its stable of optical components and cameras. It is deploying an alternative to germanium.

LightPath, based in Orlando, is using a substance that it has trademarked as BlackDiamond. Scientifically, BlackDiamond is what's known as a chalcogenide glass, which is a glass that includes one or more of the periodic table's chalcogen elements (oxygen, sulfur, selenium, tellurium, polonium, and livermorium).

LightPath CEO Sam Rubin hails chalcogenide glass as superior to germanium because, he says, it has far stronger resistance to heat, which is an important advantage in many uses including military. In technical terms, chalcogenide glass has a much lower thermo-optical coefficient, which is a measure of how much a material's refractive index changes with each degree change in temperature. Imaging systems built with germanium can require engineering modifications such as additional optics, motors, or temperature regulators, notes Rubin.

Because of those advantages, LightPath had already started to move away from germanium and to the glass prior to the Chinese ban.

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LightPath CEO Sam Rubin speaking during a tour of their facility. Credit: LightPath.

China restrictions continued from page 29

"We wanted to do it, because with our materials we can actually achieve better performances overall," Rubin says. "The Chinese restrictions have accelerated it."

For example, after picking up a line of long-range infrared thermal cameras through LightPath's acquisition of Hudson, NH-based G5 Infrared in early 2025, "we are now redesigning the cameras to replace germanium with our materials," notes Rubin.

And just this week, LightPath has augmented its material supply options for large-diameter optics, by acquiring the assets of chalcogenide glass producer Amorphous Materials in a deal worth up to $10 million.

Boules of "BlackDiamond"—LightPath's trademarked version of chalcogenide glass, which the company says is superior to germanium for many optical applications. Credit: LightPath.

Rare earths

Meanwhile, any look at materials restrictions for the optics industry would not be complete without at least a brief mention of rare earth elements. To that end, China—long the hugely dominant supplier—has in recent years unsettled the supply chain for customers across a breadth of industries by starting, stopping, and modifying restrictions.

In optics, the current state of affairs is such that any company making rare earth reliant products bound for the military is sourcing from outside of China, which can be a scramble.

One such company, Applied Energetics of Tucson, AZ, buys rare earth doped fiber that it builds into small, short pulse laser systems that disable sensors in enemy weapons and aircraft.

CEO emeritus Greg Quarles notes that Applied Energetics has successfully found suppliers of that fiber. The suppliers typically dope the fiber with the rare earth ytterbium, neodymium, thulium, holmium, or erbium, which they are buying from places including Canada, Europe, and Australia.

"There were impacts of it (Chinese rare earth restrictions) initially," says Quarles. "But it was just a matter of broadening our supply base, and finding the companies with the reputation for being able to deliver and source the materials."

Not that it has been a breeze. "Our biggest impact is typically in either delayed manufacturing due to things being stopped at the border coming in—making sure that you have all your paperwork in order—and in tariffs being placed on some of the materials," says Quarles.

Such is life in the material world.

MARK HALPER

SPIE announces Optics and Photonics Africa Scholarship

At Tuesday's African Photonics Hour, SPIE Past President Peter De Groot announced the formation of a new SPIE scholarship to support the education of students studying optics and photonics at an institution in Africa. The $4,000 scholarship will be awarded annually beginning in 2026 to two outstanding students. The funds can be used for tuition and fees, textbooks, computer upgrades, or supplies and equipment required for courses of instruction.

Enabled by a generous individual donation matched by SPIE through a new program, the scholarship is the first from SPIE to target students in Africa. It complements the Ghana Photonics and Optics Lab, scheduled to open in 2026 on the campus of Kwame Nkrumah University of Science and Technology, which received $80,000 in SPIE funding.

The Society hopes to continue growing its impactful scholarship program with additional support from the community. Previously, SPIE has matched donations to fund scholarships such as the Women in Optics Scholarship, Nick Cobb Memorial Scholarship, among others. Now, SPIE has formalized the program to make it easier for interested donors to fund a scholarship.

"Supporting the optics and photonics community is foundational to the SPIE mission, and scholarships are one of the more impactful programs we provide as part of that support," says SPIE CEO Kent Rochford. "By formalizing SPIE's donation matching program, we hope to build on our long history of community support and provide an opportunity for others to maximize the impact of their generosity and give back to the optics and photonics community."

If you are interested in establishing a scholarship, details are available at spie.org/scholarships.

KEVIN PROBASCO

NKT continued from page 11

light to manipulate clouds of cold neutral atoms for highly sensitive measurements of acceleration, rotation, and even gravitational forces.

In this context, NKT Photonics laser systems are deployed in demanding environments such as vessels, submarines, and drones, where they can help, for example, navigation in GPS-denied conditions. Such applications require exceptional robustness and reliability from the laser systems to ensure performance under harsh conditions.

Serving these conditions, fiber technology has [already] proven its value, for example in fiber sensing on underwater oil pipelines. This outstanding level of robustness is possible because fiber removes movable parts from the light generation and delivery. This advantage grants excellent stability and long lifetime, while maintaining a rugged design, and makes them the perfect choice for industrializing quantum sensing solutions in real-world environments.

Outside of quantum, what major application areas is NKT Photonics targeting right now?

We have always been active in the medical sector and continue to be so, especially in markets such as ophthalmology where we are a major supplier of femtosecond lasers. In the defense market we have been active for the last ten years in Europe in directed energy for drone defense.

How is 2026 shaping up on the business side?

Sales in the US have been challenging in the past year for a variety of reasons, mainly because of uncertainty in the customer base. This year, 2026, is forecast to be a good year for NKT Photonics, a year full of challenges but challenges that we welcome and can overcome.

MIKE HATCHER

AR Alliance continued from page 23

multiple fronts, technology developers and hardware manufacturers will add more features with AI playing a central role in applications and use cases. These smart glasses will likely evolve from simple informatic displays to increasingly immersive AR devices, from narrower field-of-view and monocular displays to wider field-of-view, stereoscopic displays and a range of form factors.

What are the missing elements and key challenges facing the AR sector—and what can the photonics industry help to resolve with certain developments?

There are several challenges facing the AR industry. The first involves multiple technologies to enable small form-factor, low-power, light-weight devices which seems straightforward enough, but when you dig a little deeper you will see that this affects all aspects of the architecture including displays, photonics, optics, computing and AI, connectivity, sensors (including image sensors) and audio. Photonics plays a key role in the display and imaging sub-system.

Describe some notable events and presentations at Photonics West 2026 and SPIE AR|VR|MR Expo

There are numerous events and talks, too numerous to be listed here. However, some interesting ones, and where the AR Alliance is deeply involved is the Laser Display for AR conference session. There were also two interesting panel discussions on Tuesday—AR: Enabling Mass Adoption and AR: The Role of Research and Technology Organizations. I always look forward to this exhibition: not to be missed once again is the headset museum, which tells the story of AR and how far we have come.

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