

inspect

America

May 2025

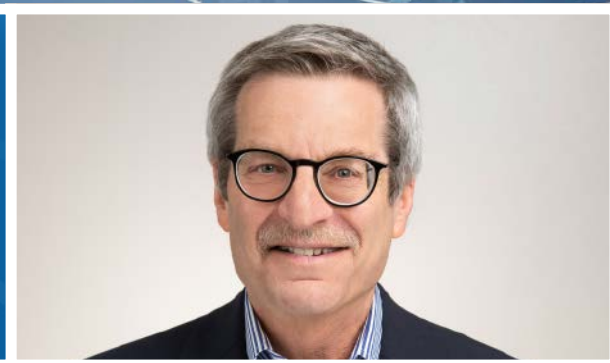
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Embedded Vision Summit:
"Solving real-world problems
with Vision and AI"



Interview with Jeff Burnstein:
"This will be our largest
Automate show ever"



Ultra-wide, No-distortion
Lenses for Obstacle
Detection and Navigation



 **AUTOMATE**

Automate Show 2025:
Machine Vision in Detroit

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The Automate show is growing and growing...

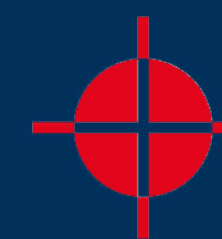
The Automate Show in Detroit starts soon, on May 12. More than 40,000 people – including me – will be looking at the innovations of around 800 exhibitors. All of this will take place over more than 365,000 square feet. My first thought, given the many miles I will cover at Automate to see as much as possible and talk to as many relevant people as possible, is about footwear. I hope you have comfortable shoes.

The second thought that comes to mind when it comes to such large trade fairs is: how much longer will they continue to develop as positively as Automate? A good ten years ago, in 2016, Automate had 350 exhibitors, not even half as many as this year. In Europe – as a European, my thoughts naturally start there – the two major trade fairs “Hannover Messe” and “SPS” in Nuremberg have long since passed their previous highs: with around 6,500 exhibitors at the Hannover Messe in 2019, and with just under 1,700 exhibitors at the SPS in 2017. Both trade fairs have taken a severe hit due to the coronavirus pandemic and are no longer growing towards their former peaks, at least not stringently.

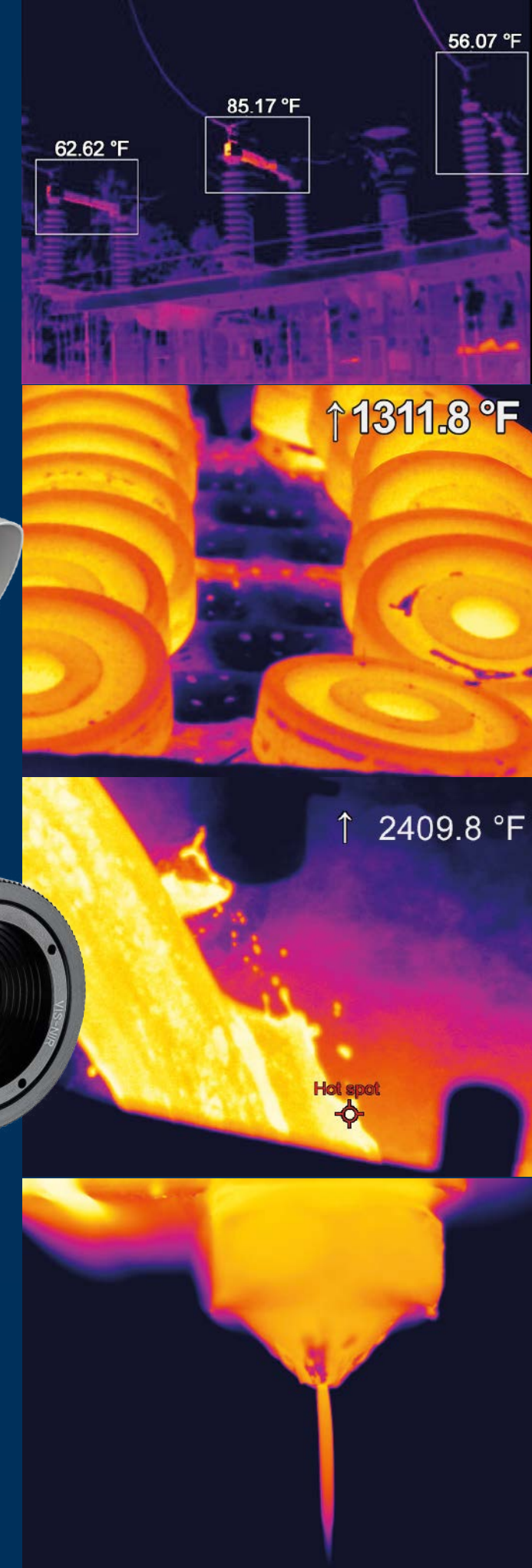
So the question is: Can the largest automation trade fair on the American continents escape the development of its German counterparts – both of which are still world-leading trade fairs? What influence do the current political and economic developments have? And in which direction? So my editorial ends without answers, but with many questions. Just like the analyses of almost all political commentators. How do you see it? Are you still an optimist?

Please feel free to write to me with your perspective. I look forward to your opinion.

David Löh
Editor-in-Chief of inspect
dloeh@wiley.com

 optris

1 μm to
14 μm



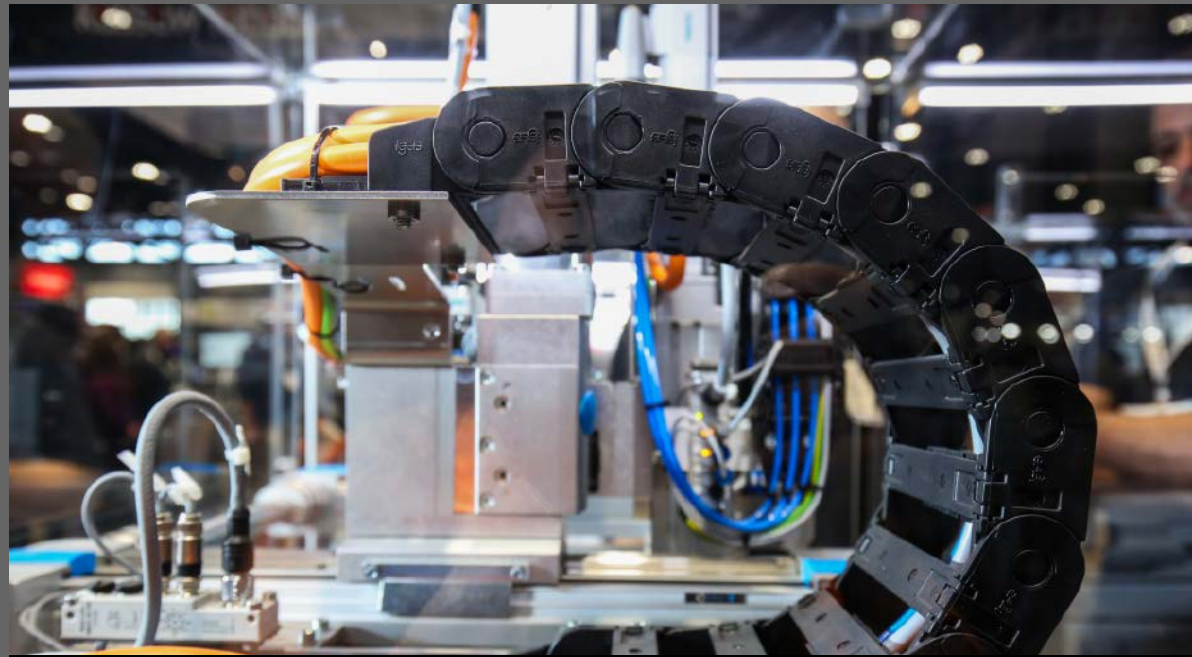
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Optimized production strategy for the US market

[Fortec Group](#) is expanding its production strategy to provide European companies with customers in the US with cost-effective and efficient delivery options. Local production in the US and pre-assembly in Egypt enable electronics companies to supply the US market more effectively. This coordinated production chain reduces high markups, as only regular customs duties of around 10 percent apply, ensuring more stable import costs and better planning security. Geographic diversification and local warehousing minimize the effects of trade sanctions and tariff adjustments, enabling European customers to benefit from shorter delivery times and high quality standards. [Ulrich Ermel, COO of Fortec](#), emphasizes that this strategy ensures long-term competitive price structures and offers technological progress and added value along the supply chain.



Ulrich Ermel

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New reinforcement for the Vision Markets team

Mark Williamson, a British expert in machine vision, joins the [Vision Markets](#) consulting team. He will use his experience in sales, business development and product management to support Vision Markets' customers. Mark is a well-known figure in the machine vision industry, having founded Firstsight Vision in the UK, which was later acquired by Stemmer Imaging. He served as managing director and was responsible for corporate development as part of the management team. He was also involved in several industry associations. Mark is looking forward to using his experience in product strategy, market understanding and business development to help customers grow in the machine vision industry. Ronald Müller, founder and CEO of Vision Markets, emphasizes how Mark's expertise strengthens the company's consulting capabilities, particularly in the areas of sales and business development.



Mark Williamson

IMTS 2026 repositions itself

IMTS 2026 presents a revised trade fair concept. Almost 90 percent of the space or 1 million square feet is already booked, with growing demand for larger stands. The show will feature innovations in physical and digital manufacturing, including CNC and hybrid machines, additive manufacturing, automation, AI, digital twins, metrology and more. The South Building will feature the Additive Manufacturing sector alongside the Metal Removal sector for the first time. The North Building will once again be home to the Automation, Gear Generation and Abrasive Machining sectors. It will also host the Smartforce Student Summit, which aims to promote STEM education and development. The West Building focuses on tools and fixtures, while the East Building offers solutions from metrology to software.

IMTS 2026 will take place in Chicago from September 14-19, 2026.



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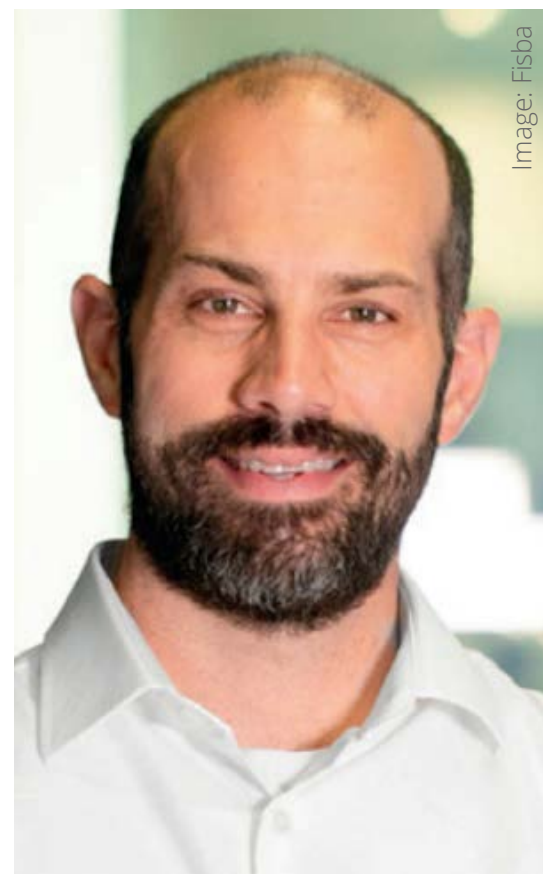


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New leadership for Fisba North America



Daniel Gray

[Fisba](#) has appointed Daniel Gray as its new President for North America. In his role, Gray will oversee sales, administration, engineering, quality and production to strengthen the company's market presence in the region. Gray, the founder and former president of Gray Optics, brings extensive experience in the development of precision optical systems.

The acquisition of Gray Optics in 2023 expanded Fisba's development capabilities in North America. Markus Hersche, CEO of Fisba AG, emphasized Gray's expertise in the development of optical systems for medical and industrial applications. Gray has degrees in optics from the University of Rochester and over 20 years of experience. Fisba thanks Wallace Latimer for his service and wishes him success in his new position in the photonics industry. Fisba is a global leader in optical design and manufacturing, with operations in Switzerland, Germany, the United States and China.

Exaktera buys Autovimation

[Autovimation](#) has been acquired by Exaktera. Exaktera, a portfolio company of Union Park Capital, opens up new opportunities for Autovimation to benefit from Exaktera's global platform and expertise, according to a company spokesperson.

Peter Neuhaus, founder and CEO of Autovimation, will remain on board and sees the acquisition as an opportunity for innovation and market expansion. "The collaboration with Exaktera will enable us to offer our customers even better solutions," said Neuhaus.

Autovimation will join Z-Laser, ProPhotonix, [Advanced Illumination](#) and [IIM](#) as Exaktera's fifth machine vision company. The company, based in Rheinstetten, Baden-Württemberg, is known for its robust, precision-manufactured camera housings and special accessories.

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Technological partnership between MVTec and Pepperl+Fuchs

[MVTec](#) and [Pepperl+Fuchs](#) have entered into a partnership in the field of machine vision, with Pepperl+Fuchs becoming part of the MVTec technology partner program. The aim is to improve the integration and handling of their products in order to increase customer benefit through common industry standards.

Both companies want to drive the development of standards such as GenICam to make it easier to combine their technologies. Customers benefit from easy product combination and access to customer services. Pepperl+Fuchs offers high-performance sensors that can be combined with MVTec's machine vision software products. MVTec offers software such as Halcon and Merlic that combines reliability and ease of use. MVTec's technology partner program promotes interoperability and strategic partnerships to improve machine vision technology.

Zebra Technologies and Merck cooperate

[Zebra Technologies](#) and Merck have announced a cooperation around the M-Trust platform, a cyber-physical solution that is linked to a new hand scanner. This platform uses Web 3.0 technologies to ensure the verification and authenticity of products and offers flexible adaptation to new regulatory requirements. Zebra brings expertise in mobile computing and identification technologies, while Merck contributes patented authentication methods.

Together, they aim to ensure a high level of security and trust along the value chain and provide high-quality data for AI systems. The new handheld scanner combines Zebra's TC58 mobile computer with Merck's SEC reader and enables the scanning of products and the synchronization of data with the M-Trust platform. The prototype was presented at Hannover Messe 2025.



Image: Zebra Technologies

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From left: Shigenai, Section Chief, Akita Prefecture; Shindo, Vice President and Akita Factory Manager, Edmund Optics Japan; Sado, General Manager, Tohoku Electric Power

Edmund Optics relies on renewable energies in Japan and Germany

Edmund Optics has converted its manufacturing facilities in Akita (Japan) and Mainz (Germany) to 100 percent renewable energy. This measure is an important step in the company's global sustainability strategy and reduces indirect greenhouse gas emissions from the use of renewable electricity by 25 percent.

Akita specializes in precision optics, while Mainz processes polarization optics and colored glass from Schott. The Akita site now sources hydroelectric power, and Mainz uses a solar energy system and green electricity tariffs. This transition highlights Edmund Optics' commitment to sustainable manufacturing and reducing its environmental footprint. The company continues to work on energy efficiency and the use of renewable energies at all its global sites, maintaining the quality of its production and encouraging other companies to take similar initiatives.

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WORLD OF VISION

Digitale Events 2025



16. April 2025:

Metrology & Precision Manufacturing

Hohe Qualitätsstandards und die Optimierung der Produktionseffizienz stehen im Mittelpunkt moderner Fertigungsprozesse. Beides ist für Hersteller von entscheidender Bedeutung, um wettbewerbsfähig zu bleiben. Bei dieser Veranstaltung geht es daher um Messtechnik, Produktionssoftware und Bildverarbeitung – kurz gesagt: Technologien, die zur Optimierung Ihrer Produktion beitragen.

4. Juni 2025:

Machine Vision, Robotics, and AI combined

Nur Roboter mit der Fähigkeit zu sehen, können komplexe Aufgaben wie das Greifen in die Kiste oder die Handhabung unsortierter Objekte auf Förderbändern ausführen. Kameras sorgen für diesen Sehsinn. In Kombination mit künstlicher Intelligenz ist das Anwendungsspektrum immens.

25. Juni 2025:

Panel discussion: What were the biggest trends at Automate?

Auf der Automate, der größten Automatisierungsmesse in Nordamerika, wurden wieder zahlreiche innovative Produkte ausgestellt oder sogar erstmals der Öffentlichkeit präsentiert. Die Expertenrunde diskutiert die Highlights und Technologietrends, die auf der Messe zu sehen waren.

17. September 2025:

Protection & safety in automation with robots in co-op with GIT security?

Die sichere Interaktion zwischen Mensch und Roboter erfordert zunehmend neue Technologien und Lösungen. Je näher sich Mensch und Maschine kommen, desto höher sind außerdem die Sicherheitsanforderungen. In unserem Webinar betrachten wir die vollständige Sicherheitsfunktion, damit eine sichere Zusammenarbeit zwischen Mensch und Roboter gewährleistet werden kann.

Oktober 2025:

Embedded Vision: From board-level through smart cameras to intelligent vision systems.

Dieser Technologietag bietet Informationen über die neuesten Technologien und Branchentrends, stellt neue Produkte vor und beantwortet die Frage, für welche Anwendungen ein maßgeschneidertes Vision-System erforderlich ist und wann eine gebrauchsfertige Vision-Lösung die bessere Wahl ist.

Anfang Dezember 2025:

Industrial Solutions for the Mobile Automation

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Interessiert? Dann sprechen Sie uns an.

Zusätzlich zu diesen Veranstaltungen planen wir mit Ihnen auch gerne ein individuelles Webinar zu einem Zeitpunkt und zu einem Thema, das am besten zu Ihrem Marketingplan passt.

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Solving Real-World Problems with Vision and AI

Interview with Jeff Bier, Founder of the Edge AI and Vision Alliance

Jeff Bier, founder of the Edge AI and Vision Alliance, discusses the Embedded Vision Summit 2025 highlights, trends in AI-powered vision systems across industries, advancements in hardware acceleration, and the integration of vision-language models into real-world applications. The interview also provides a glimpse into the future of embedded vision and its growing impact in many industries.

inspect: What are this year's highlights of the Embedded Vision Summit?

Jeff Bier: Attendees can look forward to a program packed with top-notch speakers, a bustling [exhibits floor with over 70 exhibitors](#), a hands-on workshop hosted by Qualcomm, a brand-new vision-language model training and two fascinating keynote addresses.

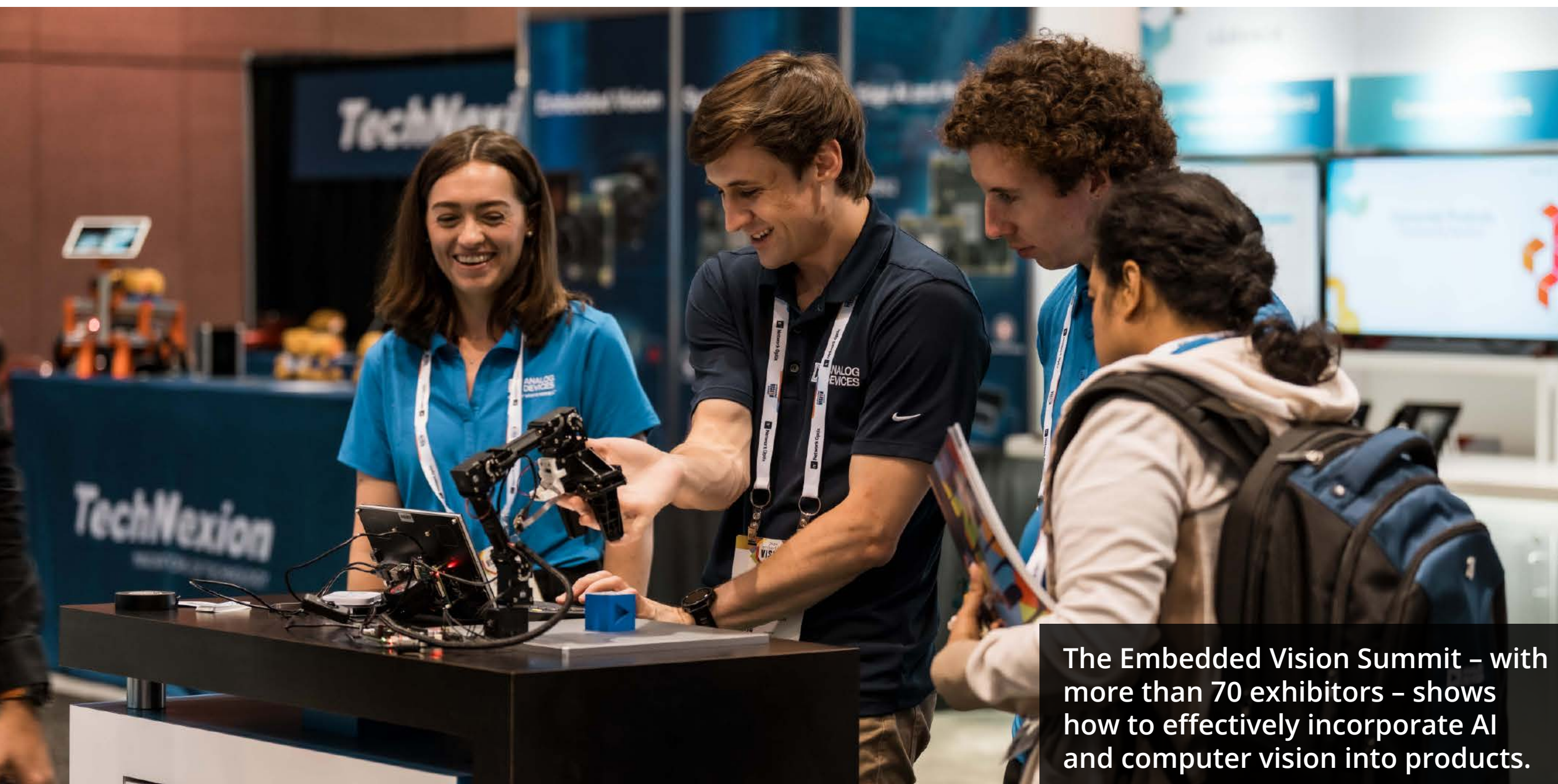
This year, we have not one, but two keynote presentations: "[The Future of Visual AI: Efficient Multimodal Intelligence](#)," by Trevor Darrell of the University of California, Berkeley, and "[Real-World AI and Computer Vision Innovation at Scale](#)," by Gérard Medioni, Vice President and Distinguished Scientist at Amazon Prime Video and MGM Studios.

Vision-language models (VLMs) are bringing remarkable new machine perception capabilities to applications. On the morning of May 20, I'll be teaming up with Satya Mallick, CEO of OpenCV.org, to lead a three-hour hands-on training session focused on [how to use vision-language models in real-world applications](#). If you're an engineer, developer or engineering manager eager to take advantage of this new technology, you'll want to attend.

That afternoon, Qualcomm will be hosting a hands-on workshop, "[Accelerating Model Deployment with Qualcomm AI Hub](#)." This three-hour "Deep

Jeff Bier, founder of the Edge AI and Vision Alliance, opens last year's Embedded Vision Summit.





The Embedded Vision Summit – with more than 70 exhibitors – shows how to effectively incorporate AI and computer vision into products.

Dive” session focuses on empowering developers with knowledge and tools to efficiently deploy optimized models on real devices using the Qualcomm AI Hub and includes opportunities to speak with deployment experts. Qualcomm has made significant advances in the past year, so even if you attended Qualcomm’s Deep Dive session last year, you’ll want to attend to learn what’s new.

We’re also looking forward to the annual [Women in Vision Reception](#) – an event that brings together women working in computer vision and AI to meet, network and share ideas!

inspect: What do attendees need to know who have never been to the Embedded Vision Summit before?

Bier: The Summit is all about practicality – how to effectively incorporate AI and computer vision into products. We’re not about hype. We’re about designing, developing and deploying products and solutions for end customers. The Summit program focuses on understanding the capabilities and limitations of current technologies, the trade-offs involved and the techniques that have proven successful.

Within the industry, there’s a growing emphasis on multimodal perception – integrating various sensor and non-sensor data sources to enhance machine understanding – which is becoming increasingly feasible thanks to large multimodal models. At the Summit, we’ll have expert presentations covering not only camera-based perception,

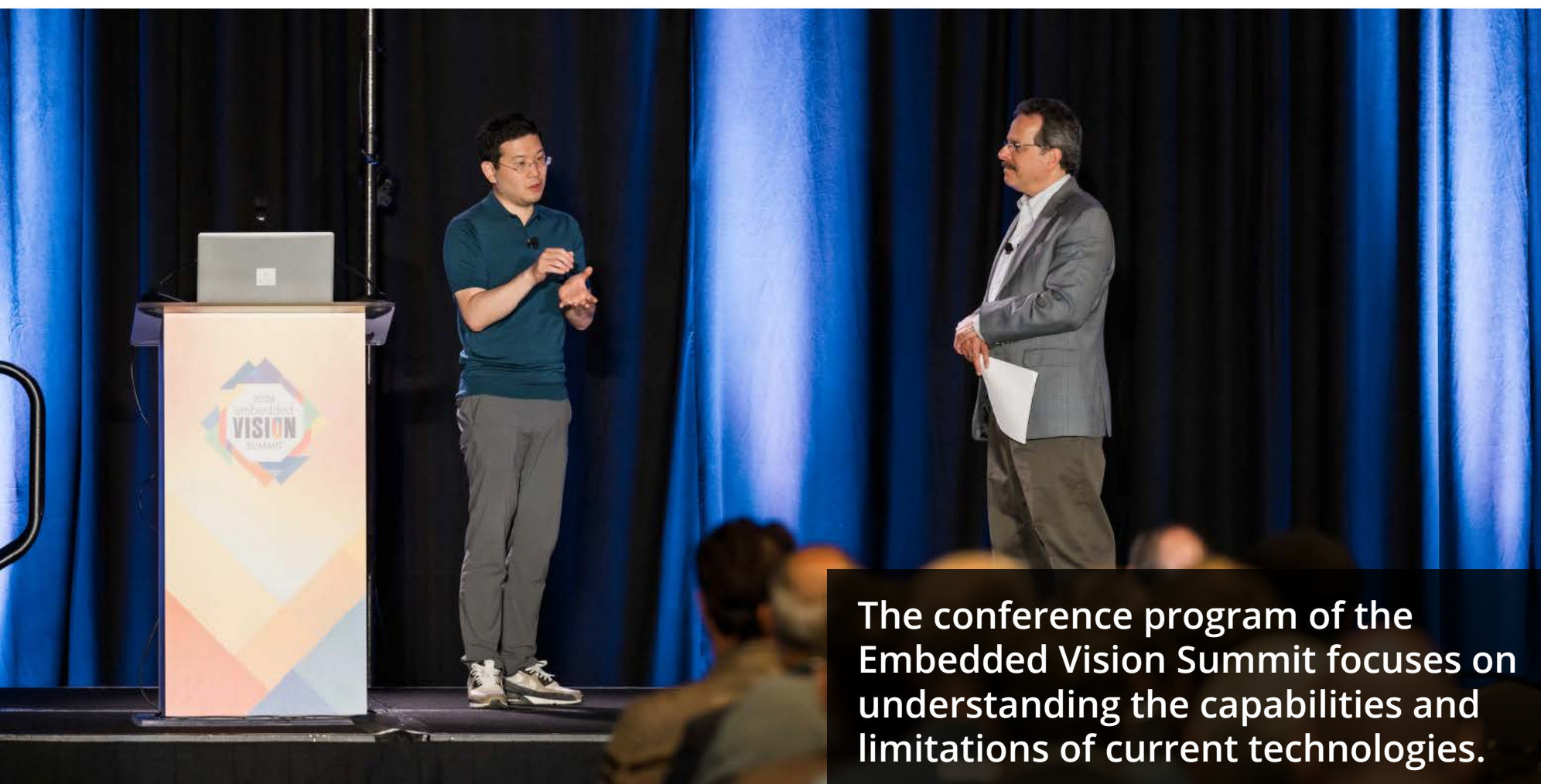
but also other sensing modalities like radar, lidar and speech, and how to combine these.

inspect: What has happened on the technical side in the past 365 days?

Bier: In the past year, we’ve seen some really exciting developments in the use of new types of models that are making it possible to tackle problems that used to be too complex or subtle for machines. For example, it turns out that a model trained on a combination of images and text can often do a better job on visual perception tasks – even in cases where the deployed model receives only image inputs, and not any text. Product developers are using a variety of approaches to achieve new levels of machine intelligence – for example, vision-language models, combinations of conventional vision models with LLMs, or using AI agents to manage collections of models. These techniques are enabling machines to distinguish, for example, between safe and unsafe situations in a much more general way than has been possible previously.

We also see a wonderful positive feedback cycle developing, as more and more engineers recognize ways to bring real value using edge AI and computer vision. They’re seeing AI in action in everyday products, like cars that automatically brake for pedestrians, or doorbell cameras that tell you when a package has been delivered. This is sparking ideas about how similar tech can improve safety and efficiency in other areas, like kitchen appliances and construction equipment.

And while it’s not quite as simple as flipping a switch, it’s definitely becoming more practical to integrate these advanced capabilities into everyday products. For many applications, you don’t



The conference program of the Embedded Vision Summit focuses on understanding the capabilities and limitations of current technologies.

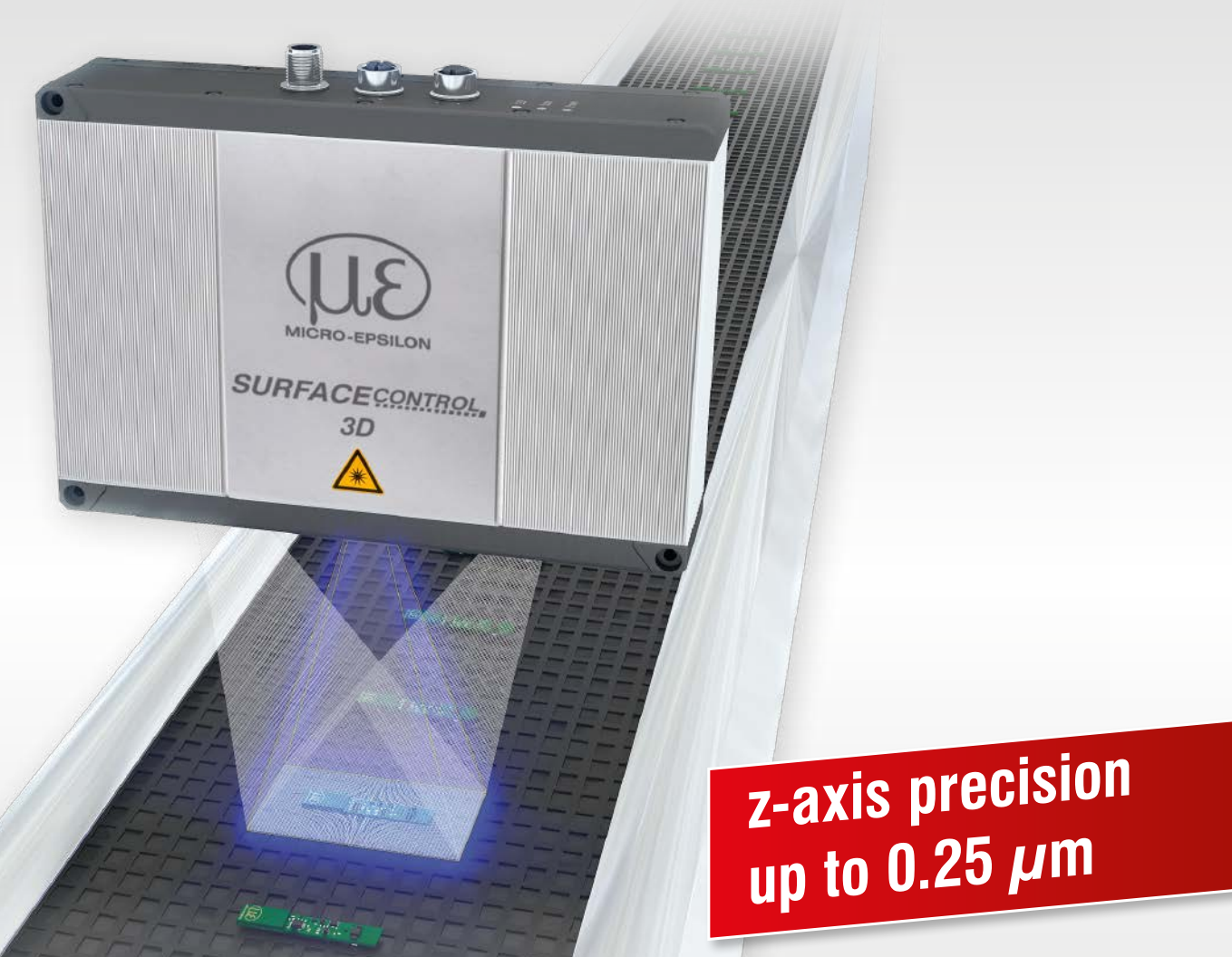
need a huge team of PhDs with decades of experience anymore, and this is really opening up a lot of new opportunities across different industries.

inspect: Which industries stand to benefit the most from AI-powered vision systems?

Bier: AI-powered vision systems are already making a big splash in several industries. First up, the automotive sector is seeing huge benefits, especially in terms of safety. Today, cars better protect drivers, pedestrians and cyclists by using perceptual AI to prevent accidents.

Then there's consumer technology, where AI is making our interactions with machines much more intuitive. Picture this: you're traveling in a foreign country, and you're looking at a restaurant menu written in a language you don't understand. You say to your wearable device, "What are the most popular vegetarian items on this menu?" Using a combination of vision, natural language understanding, and internet queries, the device responds in your native language. I believe this type of capability will become commonplace in the next few years, in a wide range of settings.

And let's not forget healthcare. AI is transforming how we diagnose and monitor health conditions. From checking moles for cancer to analyzing retinal images for heart health, these systems are increasingly as good as, if not better than, human experts. Plus, they have the potential to make

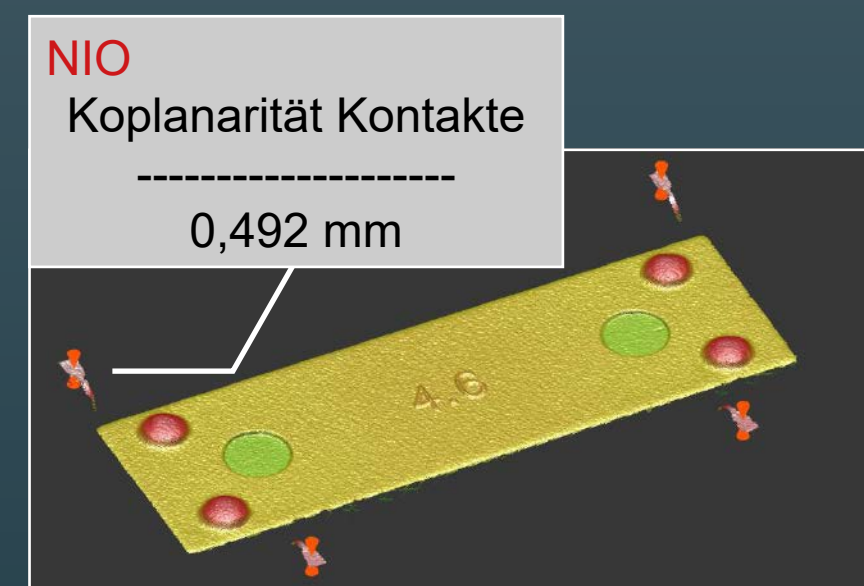


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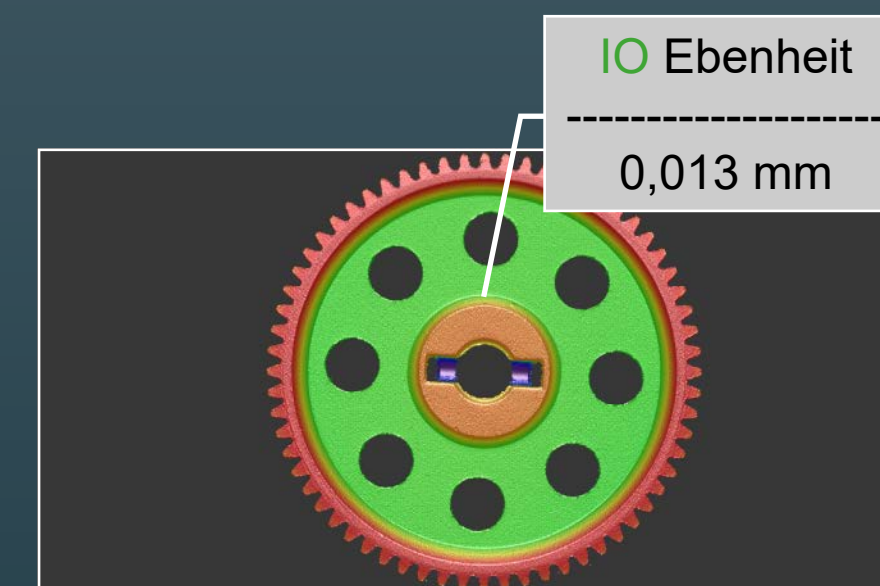
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top-notch diagnostics accessible to everyone, often through something as simple as a smartphone. This will be a game-changer for global health.

In the industrial sector, the impact of these technologies is already huge, in terms of improved quality and efficiency. We have a page on [the Edge AI and Vision Alliance website](#) with videos of more than a dozen really cool industrial computer vision and AI applications, all of which are commercially deployed solutions. These are not science projects or demonstrations – there’s everything from aircraft body damage inspection to automated construction vehicles to autonomous delivery systems.

inspect: What trends are you seeing for hardware accelerators in edge devices?

Bier: Well, first, SoCs are increasingly incorporating AI hardware acceleration, often in the form of neural processing units (NPUs). For example, Arm, Cadence, Expedita, Synopsys and Verisilicon offer NPU silicon IP blocks for incorporation into SoCs. Quadric offers an architecture that is designed for hardware acceleration suitable for both conventional computer vision as well as neural network acceleration. And Qualcomm and other chip suppliers are aggressively incorporating NPUs into their processors.

Now, if you’re talking about separately packaged hardware accelerators, there’s plenty of activity there, too. Lots of companies offer M.2 accelerator modules, and these can dramatically expand the capabilities of a smaller, less capable compute platform like a Raspberry Pi and turn it into something quite powerful as far as edge AI and vision processing is concerned. Take Edge AI and Vision Alliance Member company Memry X as an example: their M.2 module offers up to 42 TFLOPS.

Embedded Vision Summit

- **When:** Tuesday May, 20 to Thursday May 22, 2025
- **Where:** [Santa Clara Convention Center](#) (click for address)
- **What:** [Program](#)
- **Who:** [Exhibitor Directory](#)

inspect: What are the biggest challenges in integrating hardware accelerators into existing embedded systems?

Bier: There are a number of challenges: The obvious ones are things like form factor, power consumption – physical things. Does your existing embedded system have an M.2 port to plug that accelerator into? If not, will USB work? If USB, are your existing ports already maxed out?

But, in my opinion, the biggest challenge is software. AI accelerators are not always the easiest things to program. Figuring out how to get the accelerator to do your bidding in a way that doesn’t disrupt the other software or workloads you have running on an existing embedded system can be challenging – all the more so if the system has hard real-time constraints to meet, and if you have to divide the AI workload between the main CPU and the accelerator, which is often the case.

Still, for some systems, this can be a cost effective way to increase capability, to “teach old dogs new tricks,” so to speak.

inspect: What trends in hardware acceleration could redefine embedded vision in the next 5 to 10 years?

Bier: I’ve been in this industry now for more than 30 years and one of the patterns that is well estab-

lished is that, once it’s clear that an algorithmic problem is important to solve and it’s well understood how to solve it, you can do it most efficiently using specialized hardware. Back in the 1990s, programmable DSP chips were an example of this, and vision and embedded AI are not exceptions. Now, this hardware may not be fixed-function, it may be programmable in some form, but specialized hardware will almost always win over a general-purpose solution in terms of efficiency and/or performance.

A key consideration, though, is how much flexibility that specialized hardware should retain. In the case of embedded AI for vision, that is, for neural networks, we’re in a phase of rapid iteration and improvement. Convolutional neural networks were the main technique, but now transformer neural networks are becoming dominant. So the risk is that an accelerator that is too specialized won’t be able to handle the next generation of algorithms.

But the bottom line is this: specialized hardware – coupled with its enabling software – is already delivering compelling capabilities, enabling embedded vision and AI to be incorporated into a wide range of systems – even those with quite stringent cost, size or power constraints. We can expect to see this trend continue, and I look forward to seeing more and more systems that use vision and AI to solve real-world problems in all industries. ■

AUTHOR
David Löh

Editor-in-Chief of inspect

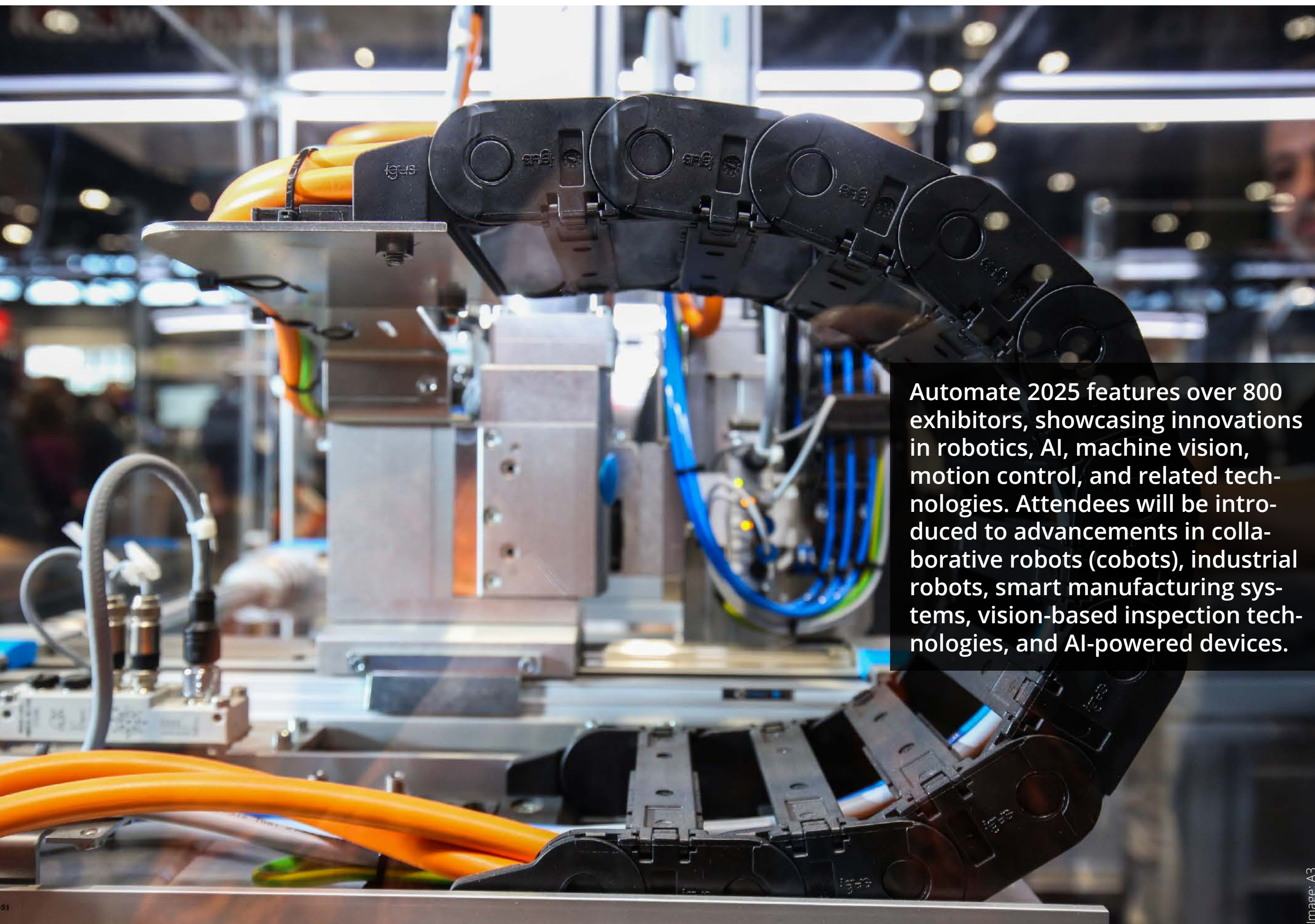
CONTACTS

[Edge AI and Vision Alliance,](#)
[Walnut Creek, CA, USA](#)

AUTOMATE – A Detailed Preview

Trade Show for Automation, Robotics, and Machine Vision

From May 12 to 15, Detroit will host the Automate Show 2025, marking another edition of this pivotal event in robotics and automation. As the largest automation trade show in the Americas, it shows the latest advancements and practical applications across numerous industries.



Automate 2025 features over 800 exhibitors, showcasing innovations in robotics, AI, machine vision, motion control, and related technologies. Attendees will be introduced to advancements in collaborative robots (cobots), industrial robots, smart manufacturing systems, vision-based inspection technologies, and AI-powered devices.

Automate 2025 features [over 800 exhibitors](#), showcasing innovations in robotics, AI, machine vision, motion control, and related technologies. Attendees will be introduced to advancements in collaborative robots (cobots), industrial robots, smart manufacturing systems, vision-based inspection technologies, and AI-powered devices. These demonstrations aim to bridge the gap between concept and implementation, showing how automation technologies can address real-world challenges. Exhibitors range from established automation giants to emerging startups, providing diverse perspectives on innovation and technology development.

Knowledge Sharing: the Conference

A hallmark of the Automate Show is its emphasis on practical knowledge through comprehensive educational tracks. Attendees will have access to technical sessions, workshops, and seminars designed to deepen understanding of automation technologies and strategies. Topics will span from integrating AI into existing processes to cybersecurity concerns and optimizing supply chains with automation. These sessions target professionals at all levels, from engineers and developers to business leaders looking to enhance operations through automation.

Keynote Presentations and Industry Insights

The event features an array of keynote speakers, including industry leaders who will discuss

More Info and Show Highlights

- [Exhibitor list](#)
- [Conference](#) (extra ticket needed)
- [The Startup Challenge](#): sponsored by Nvidia and Microsoft, featuring 10 startups competing for a 10,000 USD prize
- [The Education Pavilion](#): featuring leading universities and companies active in the robotics education space.
- [Educator Day](#): a program designed specifically for educators teaching robotics and automation courses
- [The Innovation Stage](#): offering a look at some of the industry's hottest new products, with multiple companies presenting each day.

emerging trends and opportunities in automation. Sessions will explore topics like the role of generative AI in robotics, the environmental impact of sustainable manufacturing practices, and evolving human-machine collaboration. These keynotes aim to provide attendees with a broader perspective on how automation technologies are shaping industries and societies.

Real-World Applications and Trends

In addition to the exhibits and sessions, Automate 2025 will focus on real-world applications. From AI-powered vision systems used in automotive safety to industrial robots improving efficiency in manufacturing, attendees can explore how automation is already making an impact. The event will also highlight the growing adoption of automation in healthcare, logistics, and retail, offering insights into how these technologies can enhance daily operations and end-user experiences. ■

CONTACTS

[Association for Advancing Automation \(A3\)](#),
Ann Arbor, MI, USA



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“This will be our largest Automate show ever”

Interview with Jeff Burnstein, president of the Association for Advancing Automation (A3)



Jeff Burnstein, President of Association for Advancing Automation (A3)

Jeff Burnstein shares details about Automate 2025, discussing key advancements in robotics, AI, and machine vision. The event will host over 850 exhibitors, attract more than 35,000 visitors, and feature diverse industries. Keynotes, free sessions, and networking opportunities will provide a comprehensive look at trends and innovations in automation.

inspect: Which new technologies and innovations will be presented at Automate 2025?

Jeff Burnstein: Leading advances in robotics, artificial intelligence, machine vision & imaging, and motion control will be demonstrated at the [Automate 2025 trade show](#) and discussed in depth at the [four-day conference accompanying the show](#) (fee required). Also, there will be free sessions in our [Innovation Theater](#) discussing new products, and free thought-leader sessions and panels on key topics such as humanoid robots, right on the show floor.

inspect: How many exhibiting companies do you expect?

Burnstein: We expect over 850 exhibitors occupying some 325,000 square feet at what will be our largest Automate show ever.

inspect: And how many visitors?

Burnstein: We're on pace for over 35,000 show registrants, more than a 40 percent increase from the last time the show was held in Detroit in 2023.

inspect: Which well-known companies will be exhibiting at Automate 2025?

Burnstein: Automate is a “who's who of Automation” featuring leading companies such as ABB, Agility Robotics, Beckhoff, Bosch Rexroth, Cognex, [Edmund Optics](#), Elmo Motion Control, Fanuc Harmonic Drive, JR Automation, Kawasaki, Keyence, Kuka, Nachi, Otto by Rockwell, Parker Hannifin, Schneider Electric, Schunk, Siemens, [Sick](#), [Stäubli](#), [Teledyne](#), [Universal Robots](#) and [Zebra](#). Overall, there will be exhibitors from more than 32 countries including China, India, Korea, and Taiwan.

inspect: What lectures and workshops are planned during the fair?

Burnstein: On Monday, May 12, we'll have a keynote talk from Brad Holmes, Executive Vice President and General Manager of the Detroit Lions.

- On Tuesday, May 13, the keynoter is Deepu Talla, VP and GM – Robotics & Edge AI, Nvidia
- On Wednesday, May 14, the keynoter is Amir Paul, President, North America Operations, Schneider Electric.
- On Thursday, May 15, the keynoter is Ujjwal Kumar, Group President, Teradyne Robotics



Over 850 exhibitors will show their products and solution at Automate show on around 325,000 square feet.



On Automate many industries will be presented. The automotive industry is the largest, but there are also solutions for food & beverage, life sciences, electronics, warehousing & distribution, semiconductor, aerospace, agriculture and others.

Here's our [entire paid conference agenda](#) and here you can find our [free talks in the show floor theater](#).

inspect: Which trends in robotics and artificial intelligence will be discussed at the fair?

Burnstein: The [rapid advances in AI](#) will be discussed in great detail at Automate. In fact, we're launching a new four-hour course on Designing Autonomous AI Agents. You'll also hear a lot about humanoids, autonomous mobile robots, collaborative robots, machine vision, and motion control throughout the event.

inspect: Which trends in machine vision will be presented at the trade fair?

Burnstein: One of the key trends in machine vision we'll be looking at is how AI is improving

vision applications. We'll also be teaching our basic and advanced Certified Vision Professional courses –and offering testing as well for those who want to earn the CVP designation.

inspect: Are there special events or networking opportunities for visitors?

Burnstein: Our [opening networking party](#) takes place at 5:15 pm on Monday, May 12. More than 1,500 people attend. It's a great opportunity to network with industry leaders. On Wednesday, May 14 we hold our Engelberger Awards Ceremony & Dinner where we will honor industry leaders in the categories of Leadership and Education. Both of these are paid events.

inspect: Which industries will be particularly represented at Automate 2025?

Burnstein: In terms of industries attending Automate, we get a wide variety. The automotive industry is the largest, but we also see customers attending from food & beverage, life sciences, electronics, warehousing & distribution, semiconductor, aerospace, agriculture, construction – just about every industry you can think of will find a relevant solution at Automate. ■

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all images: A3

“Easy integration and flexibility are becoming increasingly important”

Interview with Ulf Schulmeyer, Product Manager Merlic at MVTec, and Dr. Stefan Meier, Ecosystem Manager for Industrial Edge at Siemens



Ulf Schulmeyer,
Product Manager
Merlic at MVTec

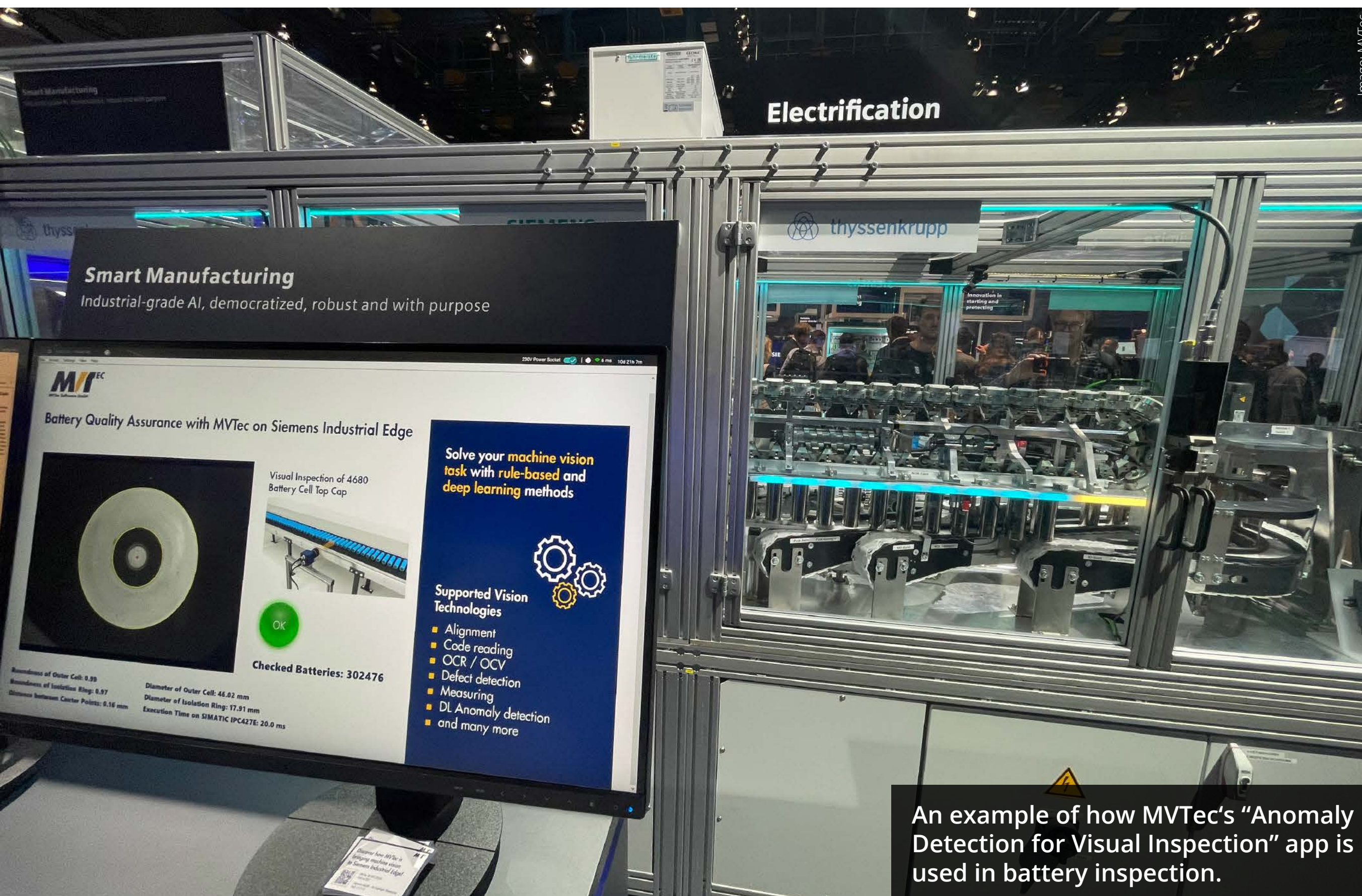
In this interview, Ulf Schulmeyer from MVTec and Dr. Stefan Meier from Siemens explain how machine vision apps facilitate the integration of machine vision into manufacturing automation. They discuss the challenges posed by the shortage of skilled workers and demonstrate how such user-friendly and flexible solutions can help overcome them. MVTec's Anomaly Detection for Visual Inspection app is currently available in the Siemens Industrial Edge ecosystem. But this is just the beginning.

inspect: What challenges do you see in the integration of machine vision into manufacturing automation?

Ulf Schulmeyer, MVTec: As in many other areas, the ongoing shortage of skilled workers is a determining factor here. The number of machine vision experts is not growing as fast as automation, i.e., the actual applications of machine vision in manufacturing and its integration. This means that more and more non-experts want and need to work with these applications. In order for software to facilitate this transition, the software must be intuitive



Dr. Stefan Meier,
Ecosystem Manager
for Industrial Edge
at Siemens



and easy to use. From a holistic perspective, the easy integration and flexibility of hardware and software components are becoming increasingly important.

inspect: What are the benefits of the Siemens Industrial Edge ecosystem in this context?

Dr. Stefan Meier, Siemens: Siemens Industrial Edge is an easy-to-use, IT-secure, and, above all, scalable edge computing solution for industrial

applications that consists of a ready-to-use hardware and software infrastructure, as well as other optional applications. This centrally manageable, microservices-based architecture uses state-of-the-art IT standards, such as Docker or MQTT, and brings these technologies close to the manufacturing and automation processes in the factory. Depending on the objective – such as equipping machines or lines with predictive maintenance, IT system connectivity, or quality monitoring – dif-



The app is aimed at users who want to create their applications within the Siemens world and use machine vision to inspect surfaces for defects automatically, precisely and robustly, for example in quality control.

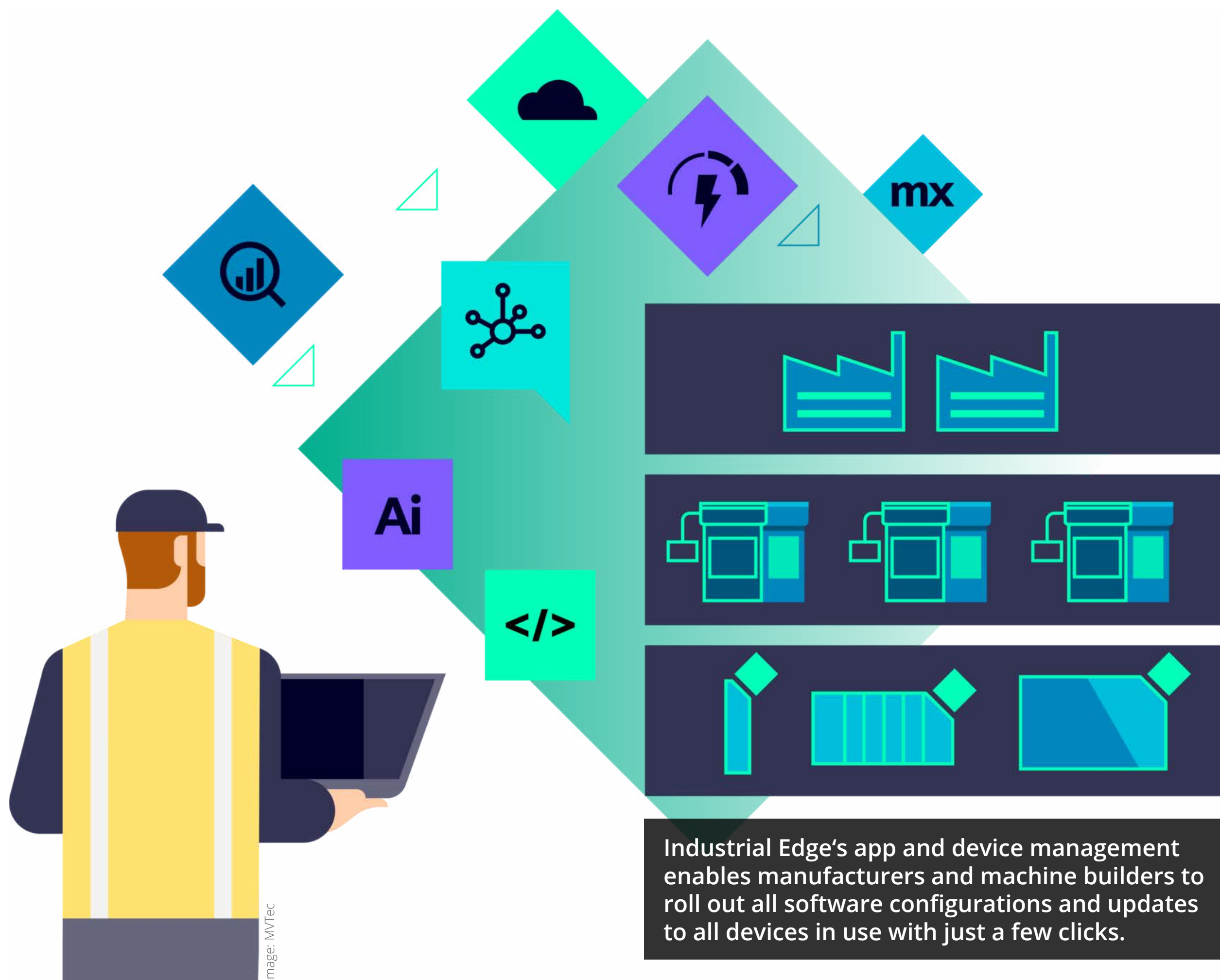


Ulf Schulmeyer, MVtec

ferent combinations of industrial edge apps and devices are used to create a customized solution. With the Industrial Edge ecosystem, Siemens is pursuing an open approach in which industry-proven solutions from third-party providers and Siemens can be combined and seamlessly integrated into automation systems. Users can select the appropriate software components, for example from MVtec, in the ecosystem's marketplace, a kind of app store.

inspect: What are the advantages for vision users?

Schulmeyer: Machine vision users benefit greatly from the integrability: all the elements they find in the marketplace work together seamlessly out-of-the-box. As complete machine vision solutions can be assembled effortlessly, customers save time and money.



Meier: Moreover, Industrial Edge's app and device management allows manufacturing companies and machine builders to roll out all software configurations and updates to all devices in use with just a few clicks. This maximizes efficiency during rollout and maintenance of the customized solution. The user is also always up to date in terms of IT security.

inspect: Can you explain how the collaboration between Siemens and MVTec led to the development of the Anomaly Detection for Visual Inspection app?

Schulmeyer: During numerous discussions between Siemens and MVTec about the challenges in machine vision, it became clear that use cases

and customer requirements are extremely diverse and require flexible and adaptable solutions. Furthermore, a low entry barrier to [machine vision software](#) is becoming increasingly important. The software must be extremely effective, yet user-friendly and easy to operate. [MVTec Merlic](#) has been meeting exactly these requirements for years.

That's why we decided to incorporate Merlic's state-of-the-art functionalities, namely [AI-supported](#) anomaly detection, into the first machine vision app in the Industrial Edge ecosystem. Thus, the Anomaly Detection for Visual Inspection app was born. Training requires only a few good images, which are generally easy to obtain. There is also no need for time-consuming labeling. Plus, the app is ideal for use cases where the high variability in the characteristics of possible defects makes them difficult to predict. Such an application would simply not be feasible without AI. But this was just the first step, our minimum viable product in the ecosystem.

inspect:: What applications is this app intended for? Are the functions comparable with the Halcon Anomaly Detection function?

Schulmeyer: Yes, anyone familiar with Halcon's "Global Context Anomaly Detection" will recognize the similarities in the app. It addresses all applications related to anomaly detection. These are mainly inspections, for example for defect detection.

inspect: What applications has the app been used for so far?

Schulmeyer: The technology is used in semiconductor production as well as in the manufacture

of fast-moving consumer goods (FMCG) and in the food & beverages and pharmaceutical sectors.

inspect: Which user group(s) is the solution aimed at?

Schulmeyer: The app is aimed at users who want to create their applications within the Siemens world and use machine vision to inspect surfaces for defects automatically, precisely, and robustly, for example in quality control. Since the app is very intuitive and does not require any programming knowledge, it is also aimed at beginners or non-experts in the field of machine vision.

inspect: The collaboration between MVTec and Siemens was presented to the public at the SPS 2023 and 2024 trade fairs, including the Anomaly Detection App in action. What are the next steps in this collaboration?

Schulmeyer: [MVTec Merlic will soon be fully available on Siemens Industrial Edge](#). This will provide a complete toolbox for implementing your own machine vision applications in a no-code development environment – classic rule-based methods and modern deep learning technologies. Their combination in particular delivers robust results, even for time-critical applications.

We owe this further step to the highly motivated, excellent cooperation with Siemens. We approach the individual companies together and advise them from different perspectives to find out exactly which use cases they have and how we can support them profitably. MVTec brings almost 30 years of machine vision expertise to the table and thus ideally complements the Siemens portfolio.

inspect: The integration of Merlic into the Siemens Industrial Edge ecosystem means not just another MVTec app, but a new level, because any apps created with Merlic can be seamlessly delivered on the Siemens Edge. How did this step come about?

Schulmeyer: For us, it is a logical consequence of the first app's development. Merlic can do so much more than "just" anomaly detection, even though this is one of the features with the most use cases. The solution-oriented simplicity and user-friendliness of Merlic, without the need for coding, is a great conceptual fit with the Siemens Industrial Edge ecosystem. We address the same target group. So it is only logical to provide them with the complete toolbox called Merlic.

inspect: How does the licensing model work in the Industrial Edge ecosystem? Does every Merlic app user become an MVTec customer, or does it go through Siemens?

Schulmeyer: The app is purchased via the Siemens marketplace. This creates a business relationship with MVTec and the customer benefits from all the services that MVTec offers – such as free application evaluations, feasibility studies, training, consulting, and of course support from our application engineers.

Meier: The entire procurement process is conveniently handled via the marketplace, regardless of whether the individual offerings come from Siemens or another provider, as in this case MVTec.

inspect: How complex is the ordering process?

Meier: The transactions in the marketplace work just like in the B2C app stores that we are used

to on our smartphones. But in the B2B space for industrial customers, there are additional requirements that make the customer journey a bit more complex, for example:

- Interactions between buyers and sellers must comply with all relevant regulations, such as export control. Marketplace customers must provide verified legal and business information.
- There are different roles in the purchasing process of industrial companies: the person who buys the product on the Industrial Edge marketplace is not the same person who uses the product later, for example in the IT department or in the factory. In the marketplace, we try to make the user journey as simple as possible for all roles involved in the process.
- The Industrial Edge ecosystem portfolio is a complex offering with multiple levels of architecture that need to be reflected in the marketplace. Depending on the chosen solution architecture, a buyer must be assigned usage licenses for the individual software components.

It is therefore quite a challenge to find the right balance between a user-friendly and simple process experience and the requirements of the industrial environment. We are continuously working on this with the Industrial Edge ecosystem and its marketplace. ■

 **AUTOMATE Booth #5207**

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Ultra-wide, No-distortion Lenses for Machine Vision Applications

Rectilinear Lenses for Improved Obstacle Detection and Navigation Efficiency

Vision systems require suitable lenses. Applications like Autonomous Mobile Robots (AMRs), bin picking, and stereo vision utilize wide angle lenses. Traditionally, only fisheye lenses captured ultra-wide fields of view, but they suffer from barrel distortion, reducing edge resolution and limiting applications. For this problem, there is now an efficient solution: rectilinear lenses.

Wide angle lenses take two approaches to representing the 3D world on a 2D plane, equal angular slices or equal planar distances.

- Equal angular slices: Each pixel captures an equal angle, leading to barrel distortion (fish-eye lens).
- Equal planar distances: Each pixel images an equal distance, producing a rectilinear lens.

Rectilinear lenses maintain straight lines, though parallel lines may appear to converge (key-stoning). This is useful when imaging objects perpendicular to the optical axis, such as LCD screens for defect detection. Unlike fisheye lenses, rectilinear lenses ensure uniform pixel coverage, preserving accuracy.

A rectilinear lens effect is 3D stretching at image edges, where objects appear elongated due to flattening along

the tangent angle. The wider the field of view, the more pronounced this effect. This effect increases edge resolution compared to fisheye lenses, benefiting object detection and positioning—critical for situational awareness and navigation in applications requiring real-time localization and mapping.

Optical Distortion

Traditional wide angle lenses (over 80-degree fields of view) exhibit curved barrel distortion due to equal angular imaging, resulting in compressed images, reduced resolution, and loss of detail at

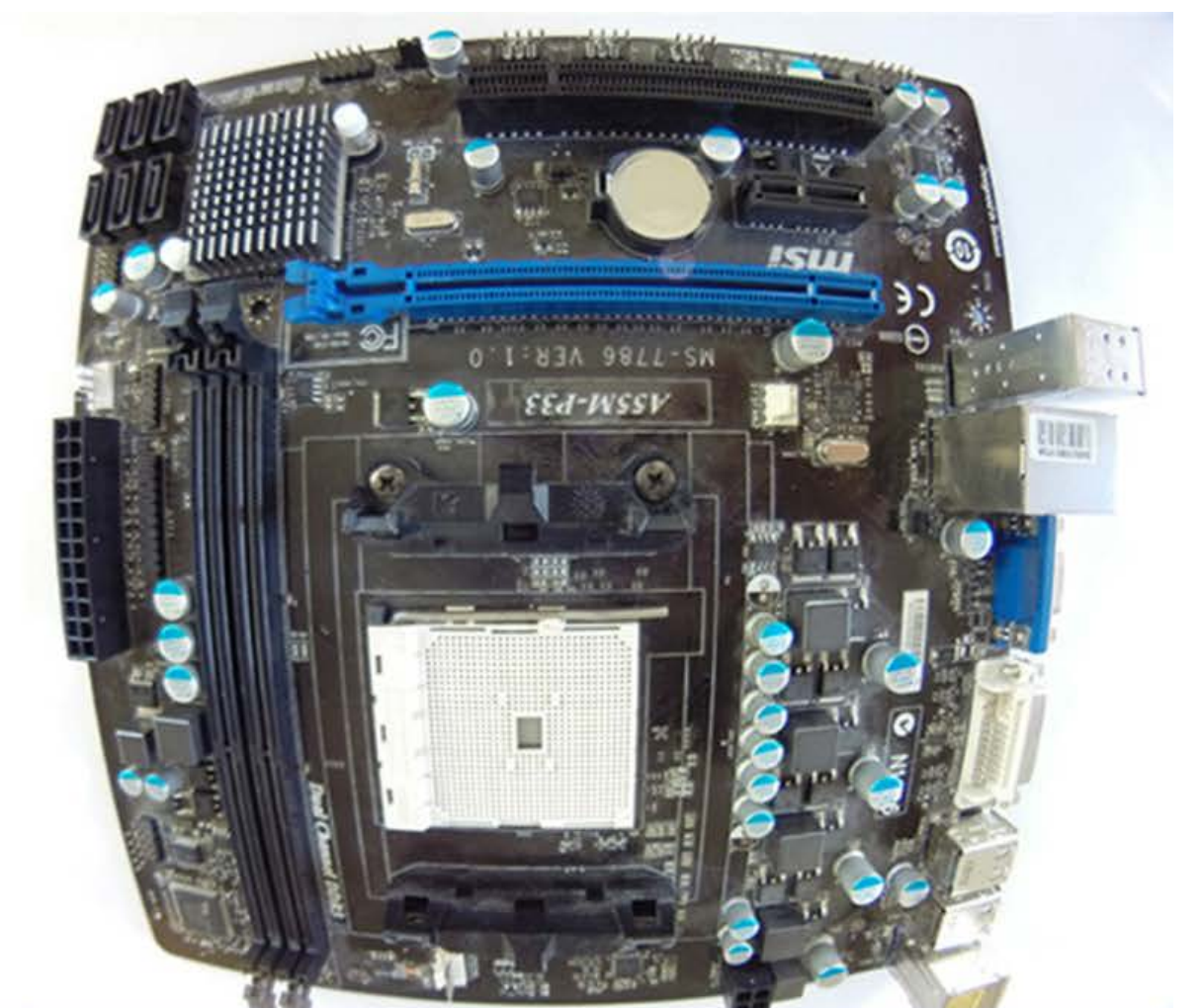
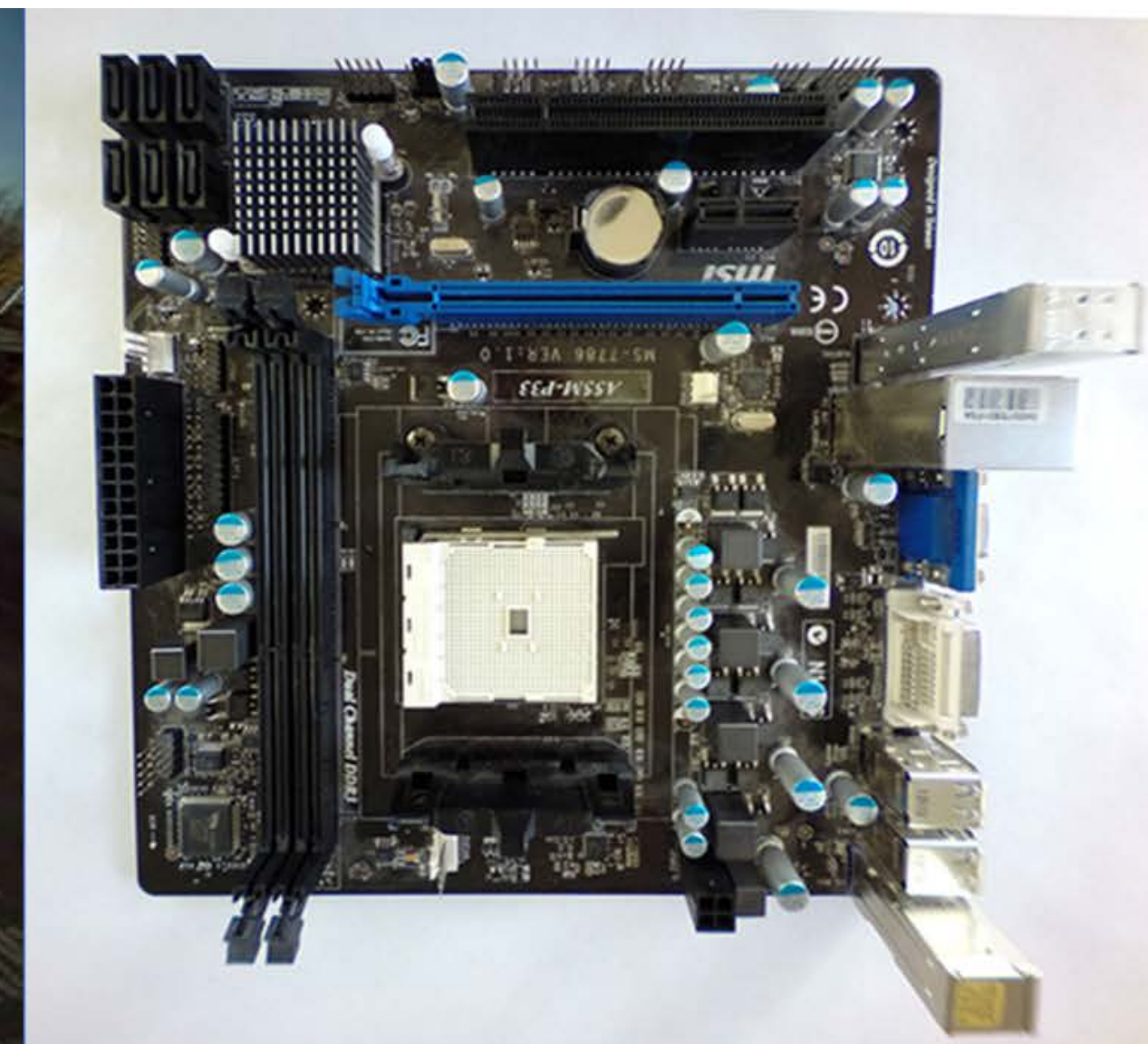


image edges. Once lost, this information cannot be recovered with software.

Software correction can convert fisheye images into rectilinear ones, but this introduces processing delays, problematic for real-time applications like AMR navigation, robotics and automation. A rectilinear lens eliminates this latency by optically correcting barrel distortion in the lens design, requiring no software intervention.

The same views with a rectilinear lens show increased edge resolution.



Technological Innovation

Theia Technologies' patented Linear Optical Technology addresses ultra-wide-angle imaging challenges. This technology enables rectilinear, low-distortion lenses with up to 135-degree horizontal fields of view across various image sensor formats. These lenses offer minimal working distances as low as 10cm ideal for short range inspection, up to 200lp/mm resolution performance, Near-Infrared (NIR) correction, ensuring consistent resolution from 435 – 940nm for multi-spectral use.

Applications

Many industries benefit from ultra-wide, no-distortion lenses. For machine vision, robotics, and automation, rectilinear lenses can enhance object position mapping, increasing situational awareness for AMRs and UAVs. Their ultra-wide, undistorted view improves obstacle detection and

navigation efficiency. Rectilinear lenses enable close focus and wide coverage in pick-and-place applications, preventing work surface blind spots. Rectilinear lenses allow real-time object tracking without latency from fisheye distortion correction, improving timing and accuracy in robotics. Increased edge resolution supports large-area inspection at close distances, such as package identification and damage detection. Ultra-wide no distortion lenses provide high-resolution monitoring for remote pipelines, eliminating the need for multiple cameras. Lastly, Rectilinear lenses improve human motion analysis with a portable setup, simplifying calibration by removing image de-warping before stitching.

Conclusion

Modern vision systems require high-performance, wide angle lenses for real-time, high-resolution imaging. Fisheye lenses introduce barrel distortion, compressing images and requiring software correction, causing latency. Rectilinear lenses correct distortion optically, eliminating software delays and preserving resolution—an elegant, efficient solution. ■

 **AUTOMATE Booth #3848**

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all images: Theia

At the Heart of the Image Acquisition Process

Event Logging System for Application Development and Debugging

In high-end inspection systems, a frame grabber is responsible for image acquisition and synchronization with numerous external devices. These devices include motion or lighting controllers, not to mention the cameras itself. Debugging these systems is complex, especially as cameras become increasingly powerful. A non-intrusive event logging system now supports developers.

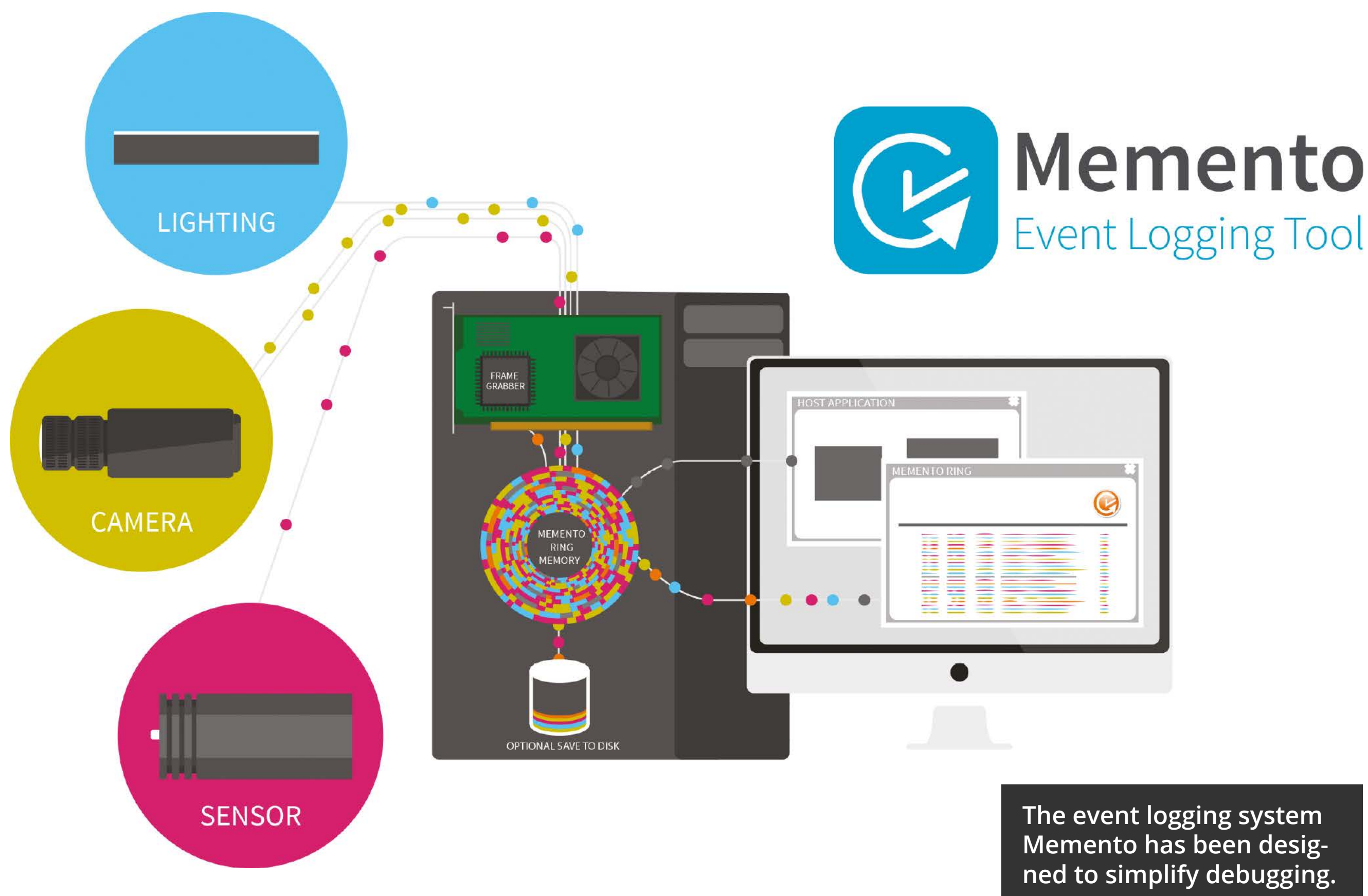
Debugging high-end inspection systems using vision often requires complex equipment, for example, oscilloscopes and logic analyzer, which are used along with software profilers. The situation is even more serious with the latest cameras available, which allow for very fast frame rates in excess of several hundred, even thousands of frames per second. Therefore, the Memento event logging system from Euresys has been designed to simplify that process.

During the operation of a Grablink or Coaxlink card for Camera Link or Coaxpress respectively, Memento records a very detailed log of events related to the camera, the frame grabber and its driver, as well as the host application. The tool also monitors the behavior of egrabber Gigelink, Euresys' universal, hardware-independent library to access GigE Vision cameras.

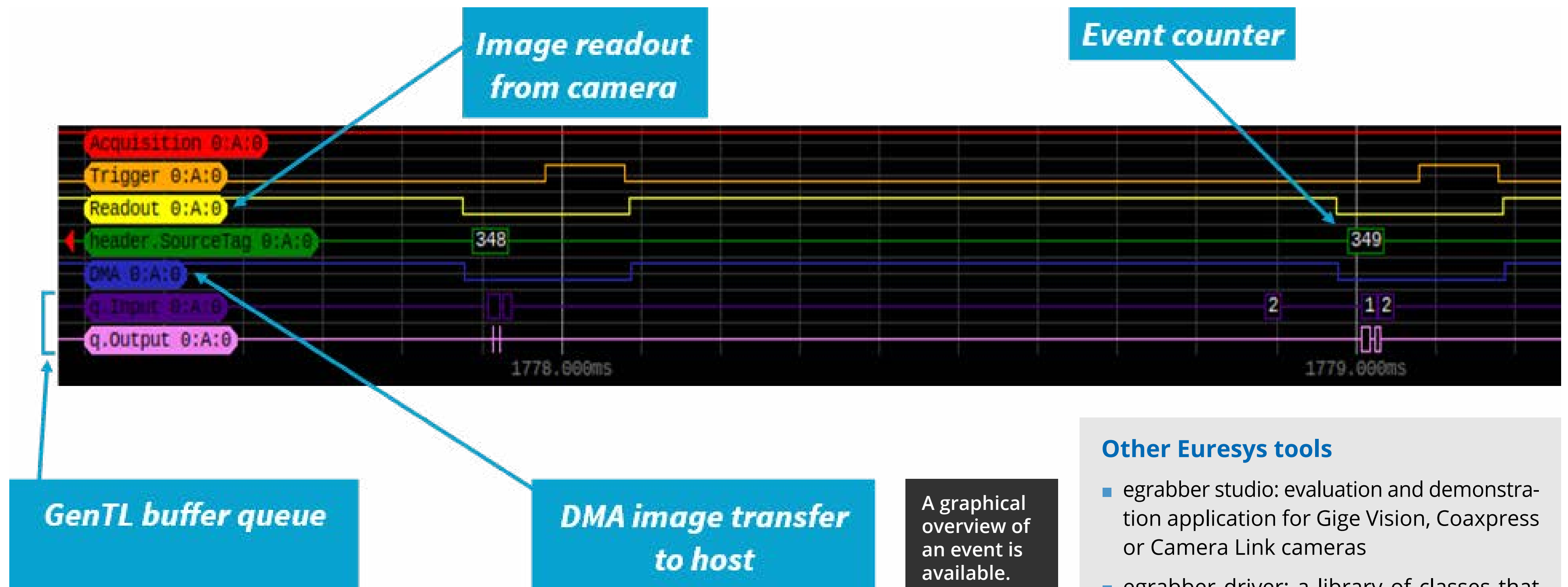
Events such as driver function calls, call backs, triggers received by the frame grabber, strobe signals sent to the light controller or camera control signals are all recorded along with precise time stamps and detailed context information.

A Graphical Overview

The event viewer is then able to display a list of these events, along with their associated time stamp and useful context information down to the microsecond. Various levels of textual detail (verbosity) can be selected. Events listed can be filtered, highlighted, and searched. A graphical



The event logging system Memento has been designed to simplify debugging.



Other Euresys tools

- egrabber studio: evaluation and demonstration application for Gige Vision, Coaxpress or Camera Link cameras
- egrabber driver: a library of classes that provides an easy-to-use programming interface for image acquisition from Coaxlink and Grablink Duo frame grabbers
- egrabber recorder: a high-performance video recording library compatible with the fastest cameras

overview of the events, as a timeline, is available and provides a fast understanding of the various signal sequences.

Memento's Advantages

During application development and debugging, Memento helps the developer understand the behavior of the machine, and pin down the cause

of issues such as missed triggers or lost images. The logging system is also useful during the operation of the machine. It runs in the background and saves logs that can be saved and sent back to the support team in case of machine failure.

The tool relies on software resources implemented inside the driver of the Grablink or Coaxlink cards as well as hardware resources on the

Grablink or Coaxlink cards themselves. It has been designed to be extremely efficient. It is non-intrusive as the required CPU load is low. ■

AUTOMATE Booth #5403

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Illumination Technology for Machine Vision

Expanded Portfolio for a Wide Range of Industrial Image Processing Applications

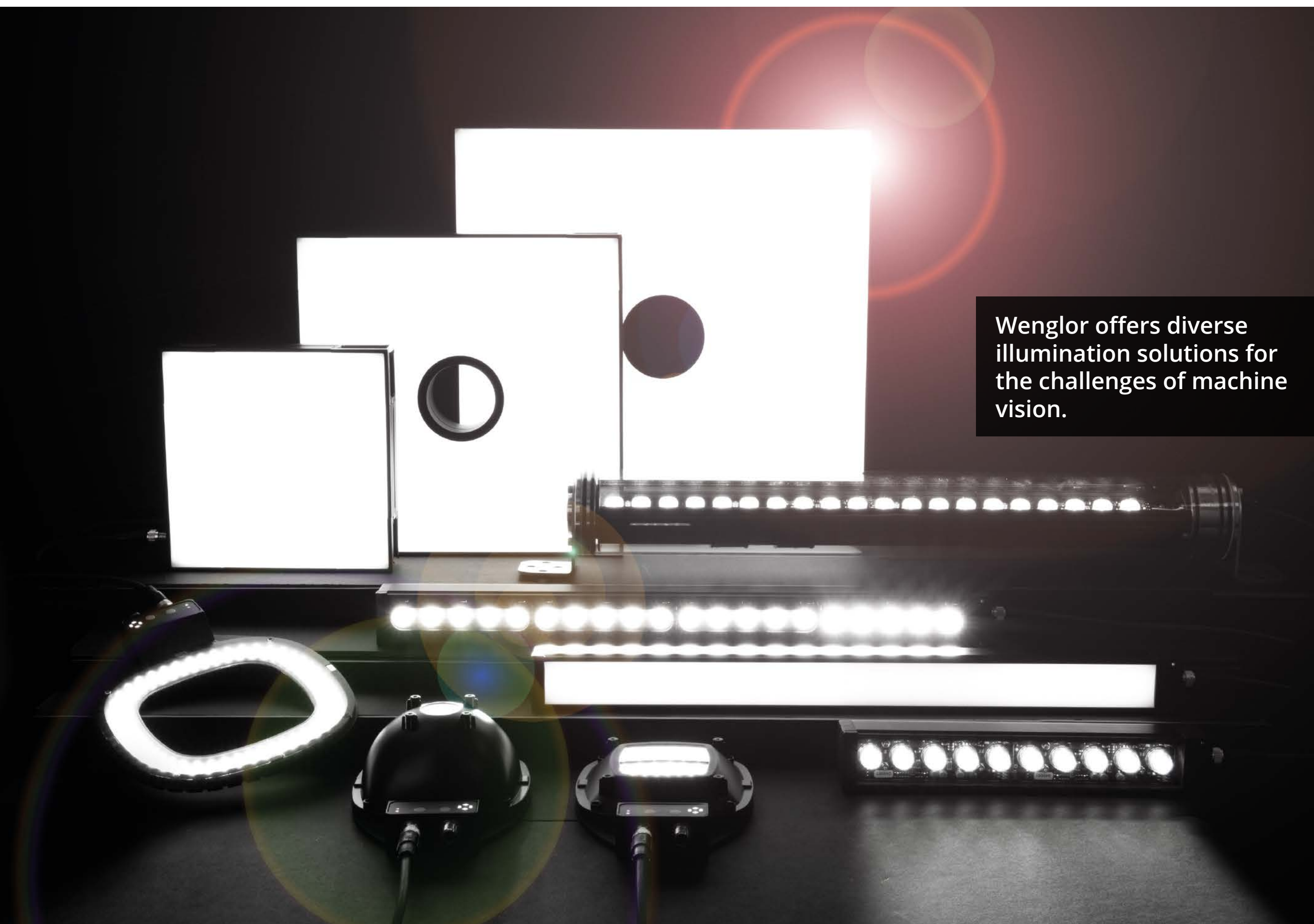
Choosing the right illumination technology is crucial for achieving sharp, high-contrast images in machine vision. Therefore, a specialist for machine vision offers a broad portfolio of LED technologies, optics, housing shapes and diffusers. This includes the latest illumination methods such as a mini bar light and a dome light.

In industrial image processing, illumination focuses on two challenges: creating shadow-free images on complex surfaces and illuminating shiny objects with strong reflections. A key component here is the dome light, which uses homogeneous, diffuse LED illumination. A modular ring light directs light upwards to illuminate the inner surface of the dome, scattering it onto the target plate. This minimizes shadows, even on complicated or irregular surfaces, making it particularly suitable for inspecting metallic or shiny objects.

With the LMDX multi-UV dome light and the LBT mini bar light, Wenglor has released two innovative solutions which feature a compact, flexible adjustment of the illumination angle, and reliable performance in changing ambient conditions.

Mini Bar Light for Confined Industrial Environments

The LBT series addresses a key challenge in industrial image processing: limited space. Its slim design allows integration into tight environments without compromising performance. This opens up new possibilities for near- and long-range applications previously limited by spatial constraints. It is important to ensure that the light is evenly distributed over the entire field of vision, especially at greater distances. The LBT mini bar light masters this task with high luminosity and homogeneous light distribution, ensuring clear vision even in the farthest parts of the visual field.



Wenglor offers diverse illumination solutions for the challenges of machine vision.

The LMDX multi-UV dome light detects fluorescent materials.



Optional angle changers simplify this process and enable individual illumination to meet the specific requirements. Thanks to its robust aluminum housing and integrated ventilation membrane, the mini bar light offers resistance to humidity and temperature fluctuations, ensuring consistent performance and durability. It can be used either continuously with high intensity or synchronously with the machine vision camera in strobe mode with increased brightness (overdrive). The combination of angle changers and polarization filters guarantees precise illumination even on reflective surfaces, ensuring clear and interference-free images. Easy to mount and flexible to connect, the LBT mini bar light facilitates integration into existing systems. Its flexibility, performance and reliability make it ideal for code reading, quality control, component inspection, label and packaging inspection, and robotics.

Counterfeit Protection of Brands

UV light has broad applications in medical, industrial and commercial areas, especially for combat-

ing brand counterfeiting via QR codes, barcodes, alphanumeric codes, images and graphics. These UV-fluorescent security markings ensure product authenticity and traceability in the supply chain. However, UV fluorescence depends on the ink type. Some inks fluoresce over a broad spectrum of UV wavelengths, while others reflect at more specific wavelengths. Traditional systems often fail to provide consistent illumination across the entire field of vision, leading to varying results and costly errors. The special dome shape of the LMDX multi-UV dome light completes this task by ensuring even light distribution. From simple code scanners to high-end smart cameras, illumination solutions need to integrate seamlessly in a variety of devices. The LMDX multi-UV dome light addresses this challenge with an integrated long-pass filter that blocks UV rays on their way to the camera. This filter can be combined with bandpass filters to increase contrast. From flash mode to continuous light mode, it offers the flexibility needed for various industrial image processing applications. This adaptability allows users to

use a single product for both UV and white light illumination, saving time and resources. As direct UV radiation can be harmful to health, the special dome shape of the LMDX shields direct UV radiation, ensuring a safe working environment.

Conclusion

Wenglor's latest illumination methods show how specialized illumination technologies can overcome challenges while increasing efficiency and precision. Whether in confined spaces or inspecting shiny materials: The LBT mini bar light and the LMDX multi-UV dome light offer flexible, robust and high-quality solutions for diverse industrial image processing needs. ■

 **AUTOMATE Booth #1635**

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all images: Wenglor

The Changing Landscape of Quality Control

Software-Enhanced 3D Scanning Metrology Solutions to Optimize Inspection Processes

Coordinate measuring machines (CMMs) are the cornerstone of quality control in manufacturing due to their precision. However, this comes at the expense of speed and flexibility, leading to bottlenecks in inspection processes. The future of metrology therefore lies in tools such as portable, software-enhanced 3D scanning metrology solutions. These systems offer an optimized user experience and integrate seamlessly into workflows. They bridge the gap between accuracy and efficiency.

In modern manufacturing, precision and efficiency are paramount. Quality control (QC) teams must ensure that products meet stringent specifications while maintaining production speed. Coordinate measuring machines (CMMs) offer high accuracy but at the cost of speed, flexibility, and accessibility. These limitations have led to bottlenecks in inspection processes, creating a pressing need for alternative solutions.

The Constraints of CMMs

Despite their reputation for accuracy, CMMs present several challenges that impact production workflows:

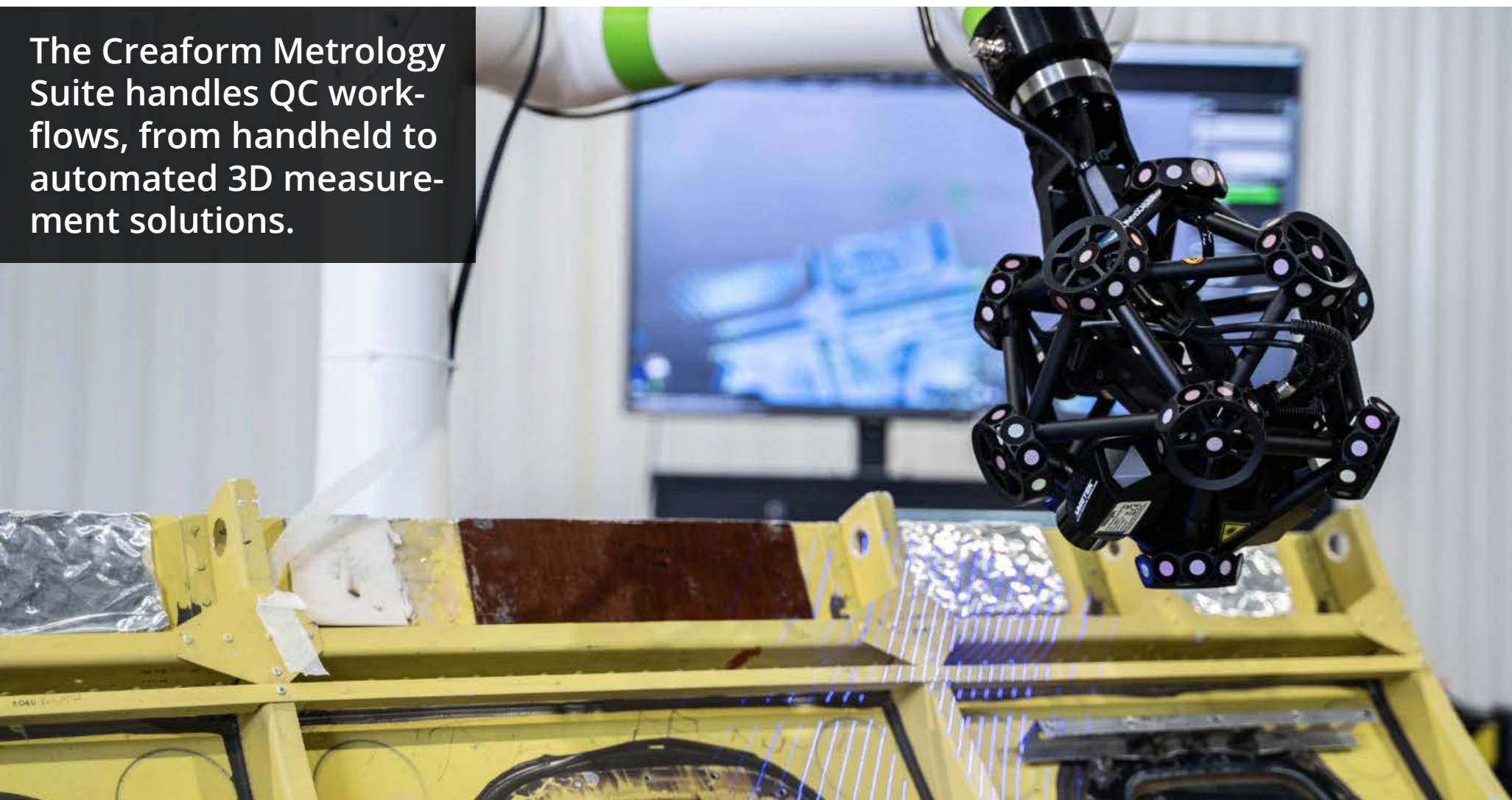
- **Slow operation:** CMMs require meticulous calibration and skilled operators, resulting in prolonged inspection times, especially for complex parts.
- **Limited flexibility:** Designed primarily for controlled environments, CMMs struggle with large, irregularly shaped components and require frequent recalibrations.
- **High costs:** Dedicated facilities, environmental controls, and ongoing maintenance add significant operational expenses.
- **Specialized training:** Operating a CMM demands expert knowledge, limiting its accessibility to only a select group of professionals.

Manufacturers have sought a solution that retains the accuracy of traditional inspection tools while offering greater flexibility and efficiency. This need has led to the development of more dynamic, software-driven metrology solutions that integrate seamlessly into existing workflows.

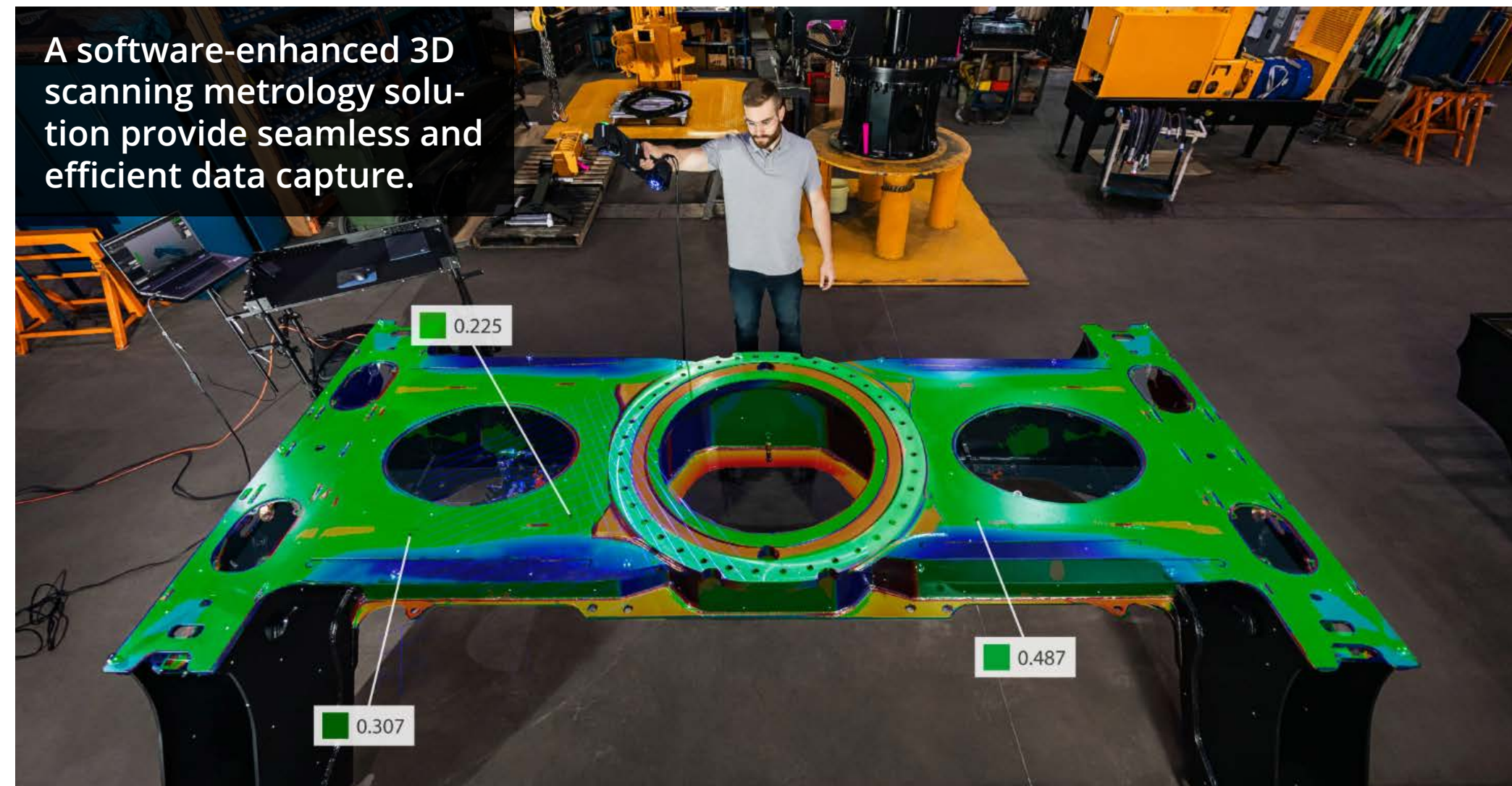


The need for efficient quality control is omnipresent in manufacturing.

The Creaform Metrology Suite handles QC workflows, from handheld to automated 3D measurement solutions.



A software-enhanced 3D scanning metrology solution provide seamless and efficient data capture.



A New Approach to Quality Control

To address the limitations of CMMs, companies are increasingly turning to portable, software-enhanced 3D scanning metrology solutions. These systems offer a streamlined, intuitive user experience that enhances productivity without compromising accuracy. One such solution is Creaform.OS and the Metrology Suite, a fully integrated 3D measurement ecosystem designed to optimize inspection processes.

Creaform.OS encompasses all acquisition modules, providing seamless and efficient data capture. Once data is collected, the Metrology Suite ensures comprehensive inspection and analysis. At the core of this suite is the Inspection module, which enables quality control professionals to evaluate scanned data against CAD models with speed and precision.

The Benefits for Quality Control

Creaform's metrology ecosystem is designed to streamline quality control processes, offering several advantages:

- Advanced inspection capabilities: The Inspection module enables real-time comparison of scanned data with CAD models, ensuring reliable quality assessments.
- Seamless workflow integration: The Creaform Metrology Suite enhances QC by connecting Scan-to-CAD, Inspection, and Automation modules for a fully integrated process.
- Intuitive interface: A redesigned UI structures workflows into clear steps, reducing training time and improving user adoption.
- Customizable experience: Configurable menus, toolbars, and preset files allow users to tailor the platform to their specific needs.
- Integrated onboarding tools: Built-in training resources accelerate learning curves, ensuring operators can quickly become proficient.

A User-Centric Approach

One of the most significant improvements introduced by the Creaform Metrology Suite is its ability to simplify data acquisition and analysis. Operators can visually confirm whether they have scanned all necessary areas before proceeding, reducing the risk of missing critical data points.

As industries continue to evolve, the demand for metrology solutions that bridge the gap between accuracy and efficiency will grow. The Creaform Metrology Suite represents a forward-thinking approach to quality control—one that acknowledges the realities of modern manufacturing while offering innovative tools to optimize production. Quality control is no longer limited to the slow, rigid processes of the past. ■

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Images: Creaform

Quality Control of Electronic Circuit Boards

AI-Powered Optical Inspection Identifies Nanoscale PCB Defects

Machine learning and AI-supported software systems can be used to improve the speed and accuracy of quality control in the production of electronic circuit boards. A specially developed deep learning software requires only a few images to adapt the inspection system to the respective application.

The size and competitiveness of the mobile phone industry has driven innovation in many industries, from imaging to software to even metallurgy. However, the semiconductor market has benefited the most. The demand for higher performance in smaller packages has been unrelenting for few decades. Apple released its latest iPhones, some powered by its new A17 Bionic chips, built on TSMC's new 3 nm manufacturing process. These chips are smaller, faster and more power-efficient than their 5 nm predecessors. Each chip is said to feature 19 billion transistors, some so small that their elements are only 12 silicon atoms wide.

According to reports, Apple will switch to a new circuit board material: RCC foils (resin coated copper). This allows the circuit boards (PCB) to be designed even thinner. However, RCC foils are very delicate, especially in the laminating process, the material is vulnerable to heat and pressure. The more complicated the manufacturing process becomes, the more important optical inspection becomes to check the quality.

Quality Control: Bottleneck in Production

Quality control is the major bottleneck in the printed circuit board manufacturing chain, including reliability testing and reworking defective boards. Improving the efficacy of quality control can significantly increase the production yield and throughput, reducing manufacturing costs and waste.



Transistors on a PCB can have many small variations that may affect performance.

Most PCB manufacturers use automatic optical inspection (AOI) to monitor defects in their boards. This delivers strong results when there are defects in soldering, connections, pads and traces on printed boards. AOI also proves to be very useful for the early detection of problems that happen during assembly, such as shorts, open circuits, thinning soldering or scratches on traces. In particular, scratches can be fatal to a board, changing its electrical properties and causing a total malfunction of the completed product.

AOI has the advantage of being included directly at the end of the PCB production line, before lamination and etching, detecting possible defects earlier than other methods. Imaging systems capture high-resolution images, with resolution down to a few microns, and then comparing them to images of a perfect model board (also known as the golden board) or with an image database of both acceptable and defective samples.

Other than performing tests on the PCB under assembly, the AOI method can monitor the manufacturing process itself. Pick-and-place machines can respond to detected defects in real-time, correcting assembly defects like component misplacement and misalignment.

Limits of Rule-based Image Processing

Still, with the demand for smaller, higher-performance parts, the resulting complexities and subtleties in material faults means that traditional manual inspection or rule-based imaging may simply not be up to the task. One semiconductor OEM needed to detect a variety of fine defects on PCB components, including breakage, abrasion, contamination, fragments, and air bubbles. However, using traditional rule-based image processing was

not providing the accuracy they required. They were facing an increase in defective parts that went undetected in their existing process, driving up costs. They needed a new solution.

To overcome these obstacles, the OEM decided to explore machine learning to meet their accuracy requirements for detecting defects on PCBs and their components. They chose Teledyne's Sapera AI inspection software suite which features the Astrocyte AI training tool. The Sapera AI software allowed them to expand on their rule-based algorithms with AI functions within their AOI machine. The Sapera AI software turned out to be a suitable solution for the OEM, allowing them to use much of their existing system while providing more accurate detection of the subtle defects that other methods would miss.

Using Sapera AI, the OEM was able to achieve 98 percent accuracy in continual classification with 12–14 ms speed for 200 images and 100 percent accuracy with 453 good and 11 bad images. Additionally, they were able to achieve 99.62 percent accuracy with 259 images and 20 ms speed for object detection when looking for multiple defects on a part image at the same time.

Improvement in Defect Detection

This is representative of the huge improvements that have been made in machine learning over the past few years. While an AI system typically needed to be trained from scratch, requiring hundreds of image samples. However, today's deep learning software is often pre-trained, so users may only need tens of additional samples to adapt the system to their specific application.

The result for this OEM was a production line that could accurately detect subtle defects on

PCBs without the need for labor intensive manual inspection. The AI functions provided a reliable and consistent alternative to traditional rule-based image processing which had previously been unreliable in detecting subtle defects.

Overall, the OEM experienced improvements in both accuracy and speed of defect detection on PCBs because of Teledyne's Sapera AI software, allowing them to reduce fallout while providing higher quality products that met their specifications.

Outlook

Today, the industry is still recovering from the worldwide semiconductor shortage that began in 2021. While analysts predict that nearly 70 percent of growth in semiconductors over the next decade will be driven by just three industries: automotive, data storage, and wireless communications, these industries are still playing catch-up from missed product launches, delayed rollouts, and higher prices. The pressure is on.

Machine learning and AI-informed software systems can improve speed and accuracy in their biggest bottleneck: quality control. Instead of a problem, companies can turn quality control into a competitive advantage, improving speed and lowering costs. ■

 **AUTOMATE Booth #3239**

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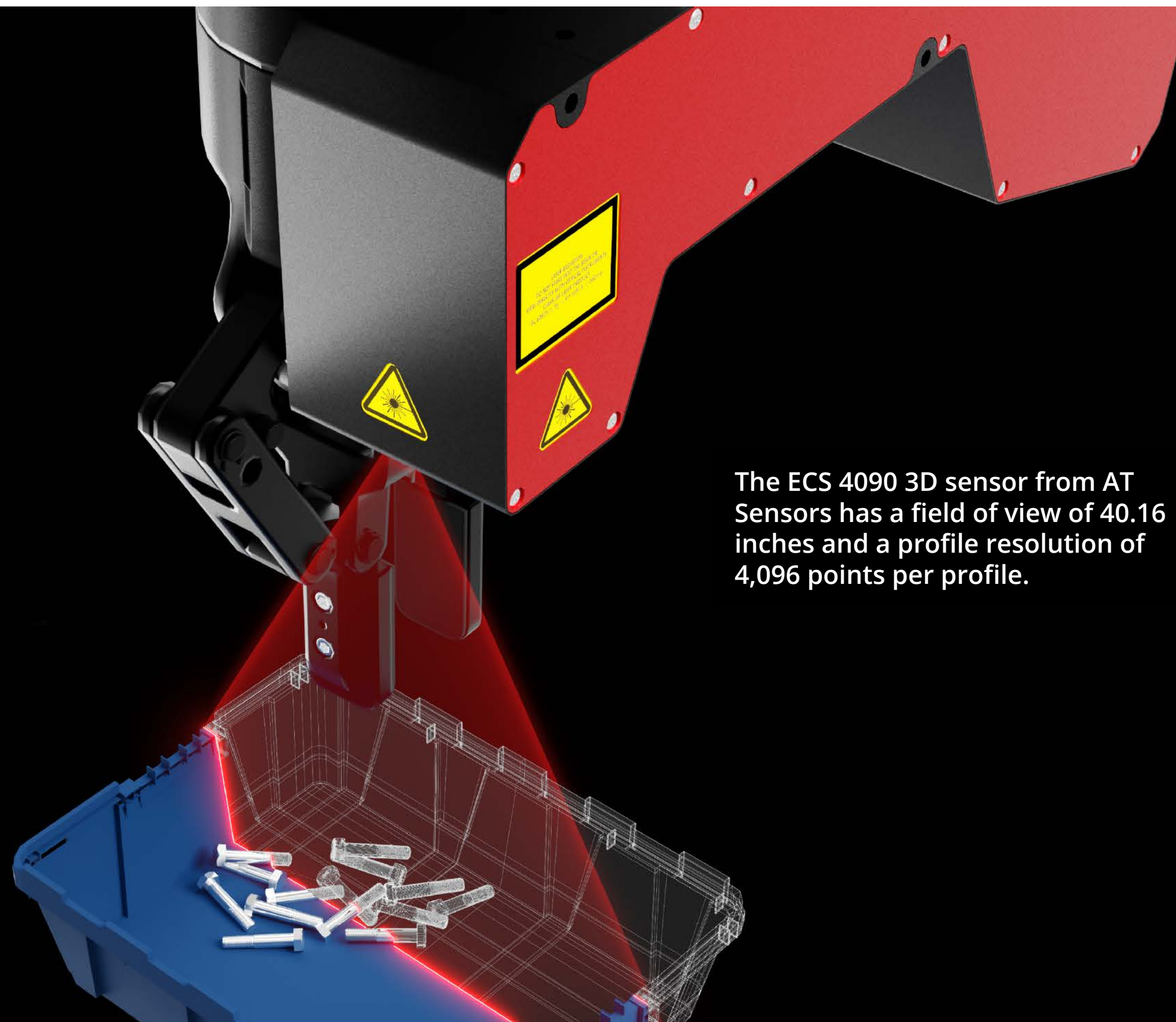
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Affordable 3D sensor with a wide field of vision

Laser triangulation sensor with a broad field of vision

The demands on modern 3D sensors are constantly growing – particularly in the areas of robot vision, the food industry and logistics. A new laser triangulation sensor combines high precision with a field of vision of up to 1,020 mm (40 inches). The large field of vision in particular simplifies numerous industrial applications.



The ECS 4090 3D sensor from AT Sensors has a field of view of 40.16 inches and a profile resolution of 4,096 points per profile.

The northern German technology company AT Sensors has expanded its affordable ECS 3D sensor series with the addition of a new product – the ECS 4090 with a field of view of 40.16 inches. This makes the sensor suitable for demanding applications in various industries where a high-performance solution is not required, such as robot vision. In bin picking, the automated picking of unsorted objects in containers, it is crucial that the sensor recognizes as many objects as possible at once.

In the automotive industry, for example, it enables the precise detection and gripping of metal parts such as screws, gears or body parts from large containers, while in logistics, packages and products are automatically removed from randomly filled storage boxes for shipping or packaging. In mechanical engineering and metal processing, too, a sensor of this kind makes it easier to precisely handle milled or cut metal pieces that have to be provided for subsequent production steps. In the food industry, it is used in the automated removal of baked goods or packaged food for further efficient processing or packaging. In addition, electronics manufacturers benefit from the sensor's high resolution, as it precisely detects the smallest components or printed circuit boards and enables robots to grip and position them securely. The technology is even used in the waste industry, where it reliably detects different materials such as plastic, metal or e-waste, thus enabling precise sorting.

In all these areas, the ECS 4090 3D sensor, with a field of view of more than 1 meter (3.28 feet), reduces the need for additional sensors or complex robot movements, thereby accelerating processes, reducing costs and optimizing automation.

High precision despite a wide field of view

In addition, the ECS 4090 delivers detailed 3D data with a profile resolution of 4,096 points per profile despite its large field of view. Its X-resolution of 251 micrometers ensures accurate measurements, enabling the detection of fine structures and surface irregularities. In addition to its technical specifications, the ECS 4090 also impresses with its ease of integration into existing systems. By supporting standard interfaces such as GenICam and GigE Vision, it can be combined with industrial machine vision systems. At the same time, the intuitive software makes implementation and operation easy, so that even companies with limited experience in 3D sensing can quickly integrate the ECS 4090 into their processes.

Another major advantage of the sensor is its price-performance ratio. While comparable 3D sensors with a large field of view and high precision often require a costly investment, the sensor offers these features at an affordable price. This makes it particularly attractive for companies that require high-quality 3D measurement technology but are not looking for a high-end solution with over-engineered features. ■

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All images: AT Sensors



Daniel Seiler, CEO of AT Sensors,
with the ECS 4090 3D sensor

Easy Vision Integration

Faster to Market Success with MIPI Vision Components

What do autonomous machines, drones and smart household appliances have in common? They all rely on camera data and onboard processing. The widely used MIPI CSI-2 interface and perfectly compatible MIPI vision components enable the quick development of such devices.



The VC MIPI Bricks include camera modules and accessories, right through to fully assembled, pre-calibrated cameras that can be used directly in the project.

Embedded vision is a key technology for integrating cameras and image processing into devices and machines. It is characterized by components that are as small as possible, optimized for low energy consumption and that perfectly match the application. Modern embedded systems with processors from Nvidia, the I.MX series from NXP, the Raspberry Pi family and other ARM-Linux based platforms meet these requirements. The MIPI CSI-2 interface has emerged as the de facto standard for connecting cameras to these platforms: It was originally developed for standardized data exchange between cameras and processors in applications such as smartphones and tablets. [MIPI components](#) are generally compact in design, powerful and energy-efficient. It is precisely these characteristics that make them the first choice for AMRs, mobile robots and other smart applications from industry to household appliances. Manufacturers of processors and embedded systems have responded to this demand from industrial applications and offer their products in industrial-grade variants with long-term availability.

MIPI Cameras for Professional Applications

In addition to the processing units, the cameras for capturing the image data themselves play a central role. Vision Components began developing industrial-grade, long-term available MIPI camera



VC MIPI cameras are suitable for industrial use and feature long-term availability. They are compatible with all common processor boards, e.g. with the new Raspberry Pi 5 including TPU Hat.

modules around seven years ago. VC MIPI Cameras are today available with over 50 different image sensors, in color and monochrome versions. With 0.3 MPixel to over 20 MPixel resolution, global shutter, rolling shutter and global reset shutter, the cameras produced in Germany cover all requirements and have proven themselves in numerous smart devices.

From Camera Module to Ready-to-use Cameras

Vision Components also offers components that enable quick and easy integration. Together with the MIPI Cameras, they form the VC MIPI Bricks system – a modular system of matching MIPI cam-

eras, accessories and services. It comprises e.g. shielded FPC cables in various lengths up to a maximum of 20 cm (about 7.9 in), as well as coax cables for cable lengths of up to 75 cm (about 30 in) and with I-Pex connectors. For even longer connections, VC MIPI Cameras are also available with a GMSL2 option for cables up to 10 meters (about 33 ft) long.

The VC MIPI Bricks system includes additional boards, for example for external triggers and lighting control. On request, customers can also receive suitable lens holders and optics, either as accessories or fully assembled and calibrated. In this case, the ready-to-use cameras can be installed

directly in the end product without any further adjustments.

New Cameras with Onboard Pre-processing

In order to support companies, Vision Components has developed the FPGA accelerators VC Power Som. The tiny boards take over the pre-processing of image data in the MIPI data stream and transfer the results to a flexible processor board. One example of this is the detection of markers in image data: The camera captures the overall image and transfers the data to the VC Power Som, where the image is analyzed and areas with markers are identified. Only these image sections are then transferred to the main processor. This means that the main processor requires significantly less computing power because the complex pre-processing has already been carried out. This gives developers greater freedom when selecting the processor board, whose resources are then primarily available for the main application.

At the embedded vision summit 2025, VC will be presenting a new camera series for the first time in the US market, in which a programmable FPGA processing unit is integrated directly into the design of the tiny camera modules. The development of this camera series also followed the company's own claim to make the integration of embedded vision into smart devices and applications easier. ■

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“With ToF, we can solve projects much more easily and at a lower cost”

Interview with Norbert Matthes, Technical Sales Manager



Norbert Matthes, Technical Sales Manager: “ToF technology enables us to tackle projects for which we previously needed several sensors and which, in addition, required complex integration.”

At SPS 2024 in Nuremberg, Germany, Contrinex introduced a groundbreaking [3D smart camera](#), marking the company's entry into the vision technology market. In this interview, Norbert Matthes, Technical Sales Manager of Contrinex, discusses the motivation behind this move, the advantages of Time of Flight technology, and the technical innovations of their new product, as well as its applications, target user groups, and future developments.

inspect: At SPS 2024 in Nuremberg, Germany, you presented a 3D smart camera. Why is sensor manufacturer Contrinex now targeting the vision market?

Norbert Matthes: With the advancement of technologies available on the market, vision systems are increasingly replacing conventional sensors. Contrinex has over 50 years of experience in measurement technology. We are convinced that vision technologies have an important role to play in the automation/sensor market. For us, this is an opportunity to supply existing markets with innovative products and to develop new ones.

inspect: And why a Time of Flight (ToF) camera, of all things?

Matthes: Contrinex has been manufacturing inductive and photoelectric sensors since the 70s. Until now, we and our customers have always measured in the three-dimensional world. ToF technology enables us to tackle projects for which we previously needed several sensors and which, in addition, required complex integration. With ToF technology, we can solve such projects much more easily and at a lower cost for the customer.

inspect: What are the technical highlights of the camera?

Matthes: The number one technical highlight is definitely the integrated image evaluation in the camera. We are also working on new use cases (pre-configured algorithms for specific applications) that can be easily adapted by the customer for their application without any experience in 3D vision. This means that the 3D smart camera can be used as a vision sensor and complex control processes can be converted into a binary signal (OK/Not OK).

In addition, we have integrated an IO-Link interface to forward measurement data to external systems in a simple and structured way. For more complex applications, customers can configure



their own algorithms and load them into the smart camera, or forward the image stream to an external processing system via an Ethernet interface. This makes our product highly flexible and a perfect alternative to conventional sensors for both expert and non-expert customers.

inspect: What applications are you focusing on?

Matthes: The main focus is on automated handling, production and packaging lines. The smart camera can control intermediate steps or the end product through the various use cases. We have use cases for level measurements of containers, where the taught images are compared with the current product as part of quality control, or packaging control for logistics applications. With our

use case editor, customers will also be able to solve less complex customized applications.

inspect: Which user group are you targeting with the camera?

Matthes: Our target group is, on the one hand, our current customers who purchase standard sensors and cannot currently find a cost-effective or functional solution for their applications on the market. But also end customers who have an automated line and, until now, without experience, have not had the opportunity to introduce vision technology to their facilities.

inspect: When will the camera be available to order?

Matthes: The product launch is planned for the second quarter of 2025.

inspect: What is the next machine vision product that Contrinex will introduce after the 3D smart camera?

Matthes: The clever system architecture in our smart camera allows us to incorporate other imaging technologies without too much effort. For example, we can integrate technologies used in thermal imaging cameras into the 3D smart camera. However, our initial focus is on ToF technology, where we plan to launch a range of variants with different image resolutions and fields of view. ■

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All images: Contrinex

“The DSX2000 is a fully automated digital microscope”

Digital microscope with AI assistance

At Evident’s European headquarters in Hamburg, Markus Fabich, Senior Manager of Strategic Marketing, and Enrico Poege, Global Marketing Communications Lead, showcased the AI capabilities of Preciv software alongside the new DSX2000 digital microscope. Central to both is the extensive support for operators, whether through automation or AI-assisted functions. A yet-to-be-released product innovation was also previewed, slated for public launch in May.

inspect: For readers unfamiliar with PRECiV software: what are its key features?

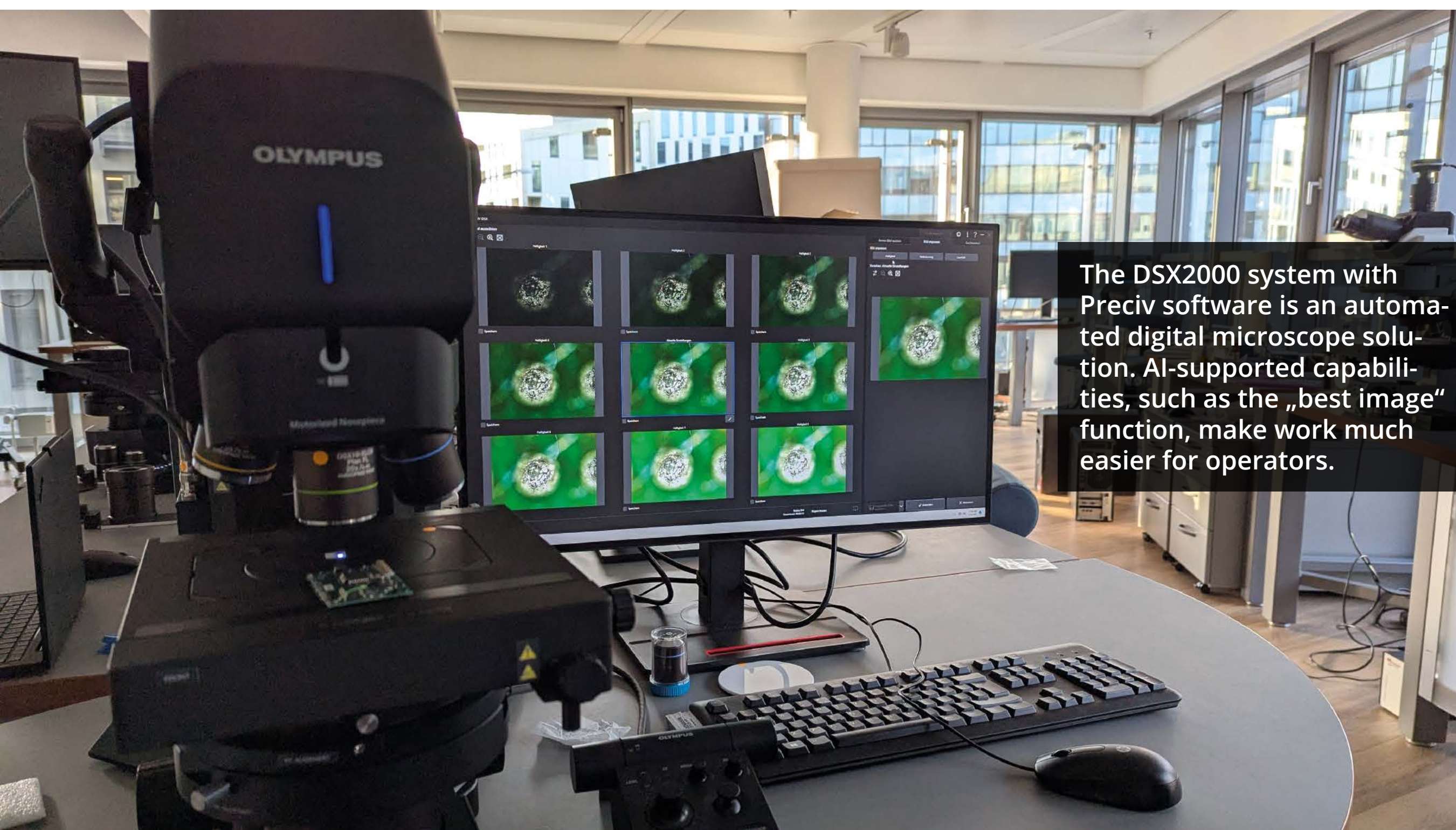
Markus Fabich: Preciv software is a comprehensive platform designed for microscopic analysis and measurement. It supports applications across research, development, and industrial quality control. The software’s capabilities extend from micrography and critical dimension measurement in circuit boards to failure analysis, series evaluations, and individual component testing.

inspect: Is the software only compatible with Evident microscopes?

Fabich: The software is specifically developed for Evident microscopes, particularly the DSX digital microscope series. However, it can also be integrated with other microscopes, provided a compatible camera is connected. In these cases, the microscope is a manual or motorized system with limited image calibration functions.

inspect: What are the main applications in which your customers use Preciv software?

Fabich: These include areas where we are recognized as a leading provider, particularly in classical metallography. In this domain, the software supports established methods such as porosity analysis. PRECiV software also facilitates geomet-



The DSX2000 system with Preciv software is an automated digital microscope solution. AI-supported capabilities, such as the „best image“ function, make work much easier for operators.



Markus Fabich (left), Senior Manager of Strategic Marketing, and Enrico Poege, Global Marketing Communications Lead for Materials Science, explain the innovations and special features of the microscopy solution.

ric tolerance evaluations and dimensional measurements, including cross-sectional analysis of conductor paths on printed circuit boards. It also enables detailed powder analysis, such as particle size classification for additive manufacturing.

inspect: Preciv has now also been given AI functions. What can users expect from these?

Fabich: Our AI model is specifically tailored to our customers' applications, with a primary focus on pattern recognition and geometric measurement. A key capability is the differentiation between "good" and "bad" samples—a process known as establishing a "ground truth." Image labeling plays a central role in generating this ground truth, ena-

bling the software to effectively recognize patterns. For example, the AI can reliably identify a circle as a circle in the context of geometric measurements. In a subsequent step, the identified feature is assigned to its appropriate size class.

inspect: Who does the training? Evident or the user?

Fabich: The user performs the training. The simple reason is that many of our customers generate highly confidential data, which we have no intention of accessing. While we could offer pre-training as a service, user autonomy remains our top priority. Users retain full control over their data and can be assured that only their data is used.

Logically, this also places a requirement on the software's usability: the training process must be designed so that users can easily perform it.

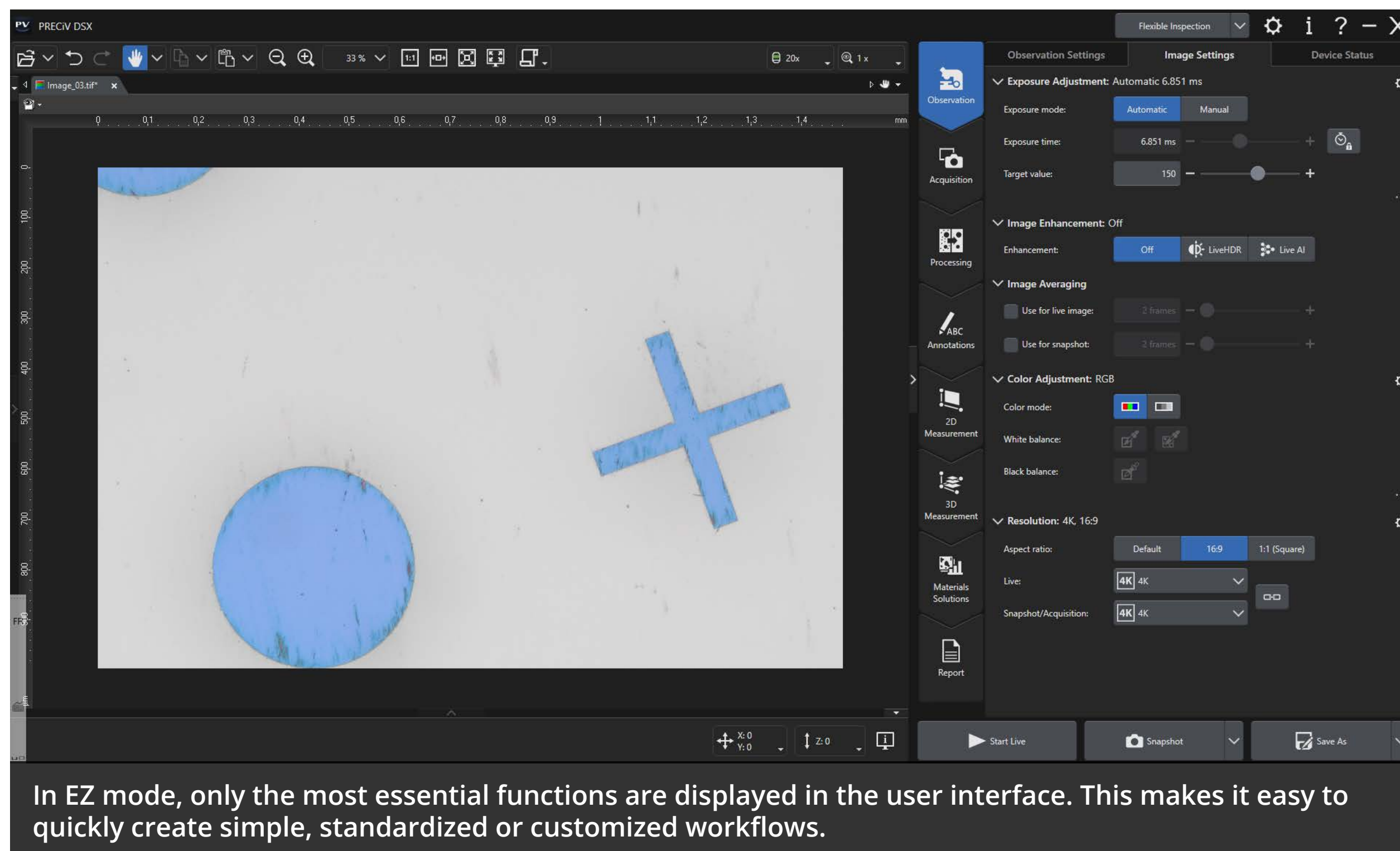
inspect: Let's assume that AI model is trained. How does the user benefit from this?

Fabich: The AI can then be activated at various stages within our software, such as during live imaging. For instance, it can measure the diameter of a circle and visually indicate compliance by marking it green if the size is correct, or red if it falls outside the specified tolerance.

inspect: With your EZ or Easy Mode and the convenience features, some of which are also AI-supported, are you addressing the shortage of skilled workers?

Fabich: We've received feedback from quality assurance professionals indicating challenges in finding specialists with sufficient microscopy expertise. The DSX system addresses this need by offering a user-friendly interface that can be learned relatively quickly with minimal training. This is largely due to its high level of automation, especially in configurations featuring the automatic revolving nosepiece for objectives.

The system also enables more structured workflows: an engineer can predefine the full process with all relevant steps. In EZ mode, the operator simply follows these instructions, with only the preconfigured functions displayed. This approach



reduces complexity and supports consistent operation, even by users without specialized training.

Enrico Poege: In addition, this approach minimizes the influence of individual operators on measurement results, which is important for comparability.

inspect: Preciv includes the Live Assistant function? What is its specific benefit?

Fabich: Provided the AI has been trained with the user's images, the system can, for example, count particles or defective drill holes directly within the live image. The results correspond to the current field of view and update dynamically. This means

that as the sample is moved, the number of visible defective drill holes is continuously displayed.

inspect: Preciv now has a Microsoft 365 integration. This means that you can export measurement results to word processing and spreadsheet programs. Can you explain this further?

Fabich: AAs you know, capturing an image and taking a measurement are only the first steps—a comprehensive report must also be created. Our Microsoft 365 plugin facilitates this process. It enables users to create templates with predefined placeholders for images and tables, streamlining report generation.

As soon as I click on “Create report in Word”, Office opens automatically allowing images from the gallery and measurement value tables to be exported to their predefined locations via drag and drop. Also, scales and diagrams can be generated directly in Powerpoint, eliminating the need for users to create them manually from the exported data.

inspect: Let's move on to the new DSX2000 digital microscope. What are its key feature?

Poege: With the DSX2000 system, we now have a fully automated digital microscope. The key innovation compared to the DSX1000 is the motorized revolving nosepiece for the objectives. It can be controlled automatically – significantly enhancing user convenience.

Fabich: A distinctive feature of this nosepiece is that it can also be used in a tilted position. When tilted, software-controlled rotation is disabled to prevent potential collisions between the objective and the carrier plate. However, the particularly elegant aspect of this design is that users can still reposition the nosepiece manually. This combination of automated and manual operation is a capability we did not offer before.

inspect: What is the advantage of a digital microscope over an analog one?

Poege: A digital microscope makes work easier for the user through automation—for example, integrated contrasting methods can be applied with just one click. Many functions, including the previously mentioned wizards, are directly accessible via the console.

Further, users can seamlessly switch between different imaging modes, such as differential inter-



ference contrast to brightfield, directly from the console. Users can choose the ideal imaging conditions depending on their current needs, without having to exchange optical components.

inspect: Let's take a step away from digital microscopes: Where are analog microscopes mainly used today?

Fabich: Certain specialized applications may require solutions beyond the capabilities of the DSX2000 system. For instance, its sensor does not support infrared imaging.

In cases where only a cost-effective camera is needed and a single illumination method is used, a component-based microscope can be the optimal choice for standardized workstations.

For certain specialized applications, such as wafer inspection in the semiconductor industry, a classic system may offer greater advantages. In these cases, the MX63 microscope, with its large and stable stand, can be particularly beneficial.

The versatility of modular microscope systems, combined with the ability to view samples directly with the naked eye, continues to be relevant for these specialized applications.

inspect: The DSX2000 features the so-called Best Image function. How does it work?

Poege: This function primarily gives the operator certainty when using the contrast methods. There is no longer a need to know exactly which lighting technique is optimal for a given situation. The software also goes a step further: it automatically evaluates the available lighting techniques and enables the operator to select, with a single click, the image where the feature of interest is most

clearly visible. This helps prevent situations where it is only realized afterward that a different lighting technique would have provided better results.

Fabich: I would also like to add that once the optimal setting has been found, it can be saved. This enables the same parameters to be applied to other samples. As a result, the best image function not only assists in finding the ideal mode for a particular sample but also facilitates consistent imaging across multiple analyses.

inspect: What will Evident be presenting to the public next?

Fabich: We are developing the DSX series into a comprehensive ecosystem. The first accessory is a macro camera that is equipped with a 1/4-inch thread and can be mounted on the side of the microscope or in another suitable location. The camera's cable length is long enough for flexible use. In addition, a new operator workflow called "macro camera" is being integrated into the DSX software.

In failure analysis, for example, the camera enables pre-focusing of a sample before placing it under the microscope, letting users locate regions of interest more efficiently. Alternatively, it can also be used as a standalone macro station, where it takes on the tasks of a mobile camera. Macro images captured with the camera are immediately available within the DSX ecosystem and can be seamlessly integrated into reports. The macro camera will be a special highlight at the upcoming Control trade fair in Stuttgart. ■

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Paint Defect Inspection in Automotive Production

Visualization of Reflective Surfaces Using Deflectometry

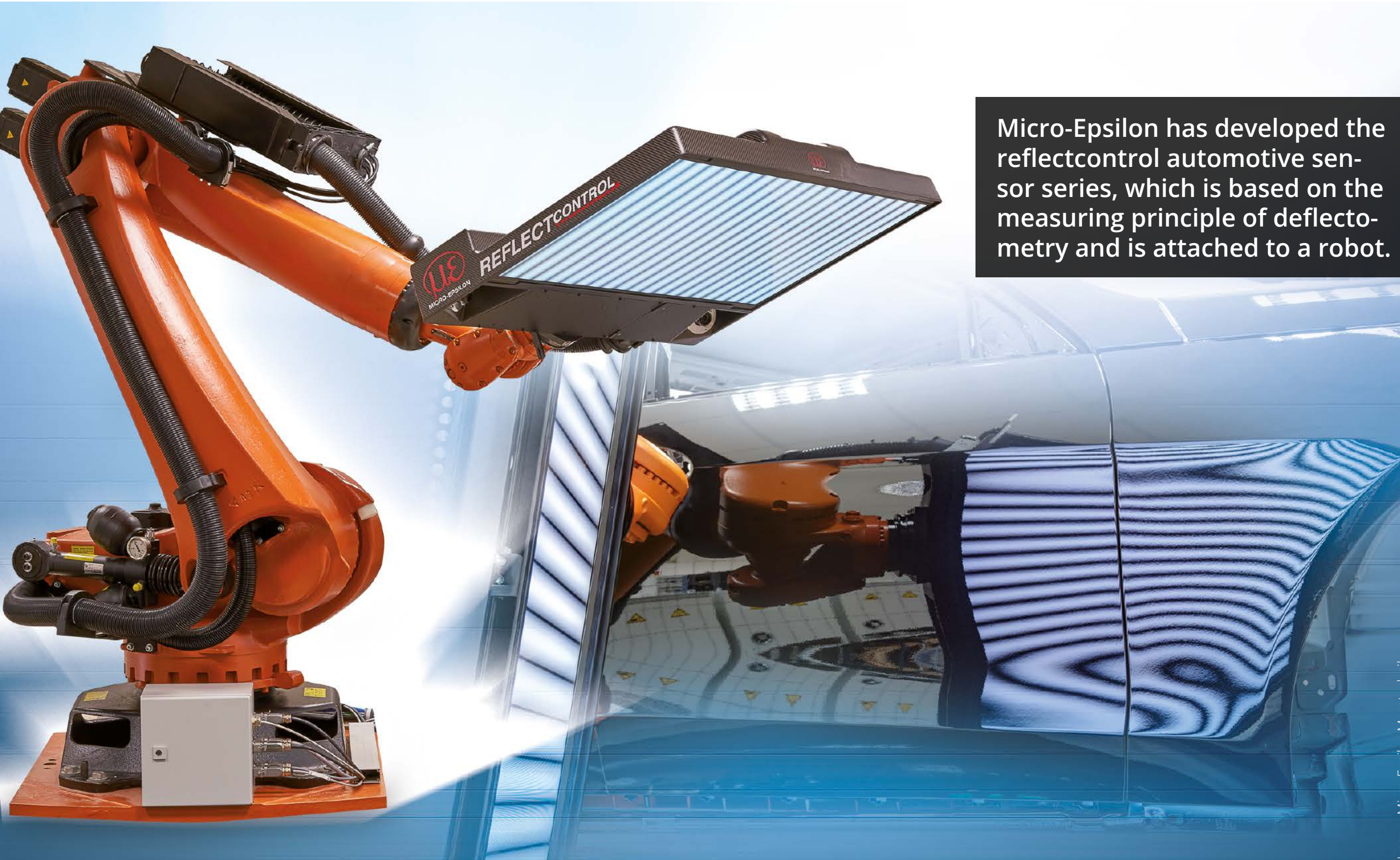
3D inspection systems visualize surfaces down to the smallest detail. This is necessary in the automotive industry, for example, for checking paint defects. Because even the smallest defects or inclusions in the paint lead to costly reworking. Deflectometers help to detect errors quickly and reliably and to process these automatically.

More and more industrial applications require reflective surfaces to be recognized and measured. For example, in electronics manufacturing in smartphone production or in the automotive sector when producing mirrors or checking paint defects on a finished car body. In order to detect a fault or defect on these surfaces, OEMs require systems that measure with high precision and detect deviations in the surface structure in the sub-micrometer range.

Micro-Epsilon has developed the reflectcontrol sensor series, which is based on the measuring principle of deflectometry, for all these fields of application. Here, the sensor displays a sinusoidal striped pattern via a monitor, which is reflected into the sensor's cameras. The surface of an object being measured is, for example, a car body. The resulting phase images can be used to calculate so-called kernel images based on the measured variables of base intensity, amplitude and curvature.

High-resolution Measuring System

Micro-Epsilon's reflectcontrol automotive is known as PSS 8005-D and has a measurement area of 367.5 x 823.4 mm (about 14.5 x 32.4 in). The sensors measure even the smallest defects with a resolution of 185 μm and work with a measurement data acquisition time of 400 ms. The supply voltage is 24 V DC with a power consumption of less than 200 W.



The high-precision resolution benefits, for example, the paint defect inspection of car manufacturers. In the past, they relied on light tunnels in which skilled workers would use fixed lighting systems and cameras to detect defects in the paintwork. Alternatively, systems with static sensors, which the car body moved past on a conveyor belt to detect defects. However, both are options are very error-prone.

Suitable for Short Cycle Times

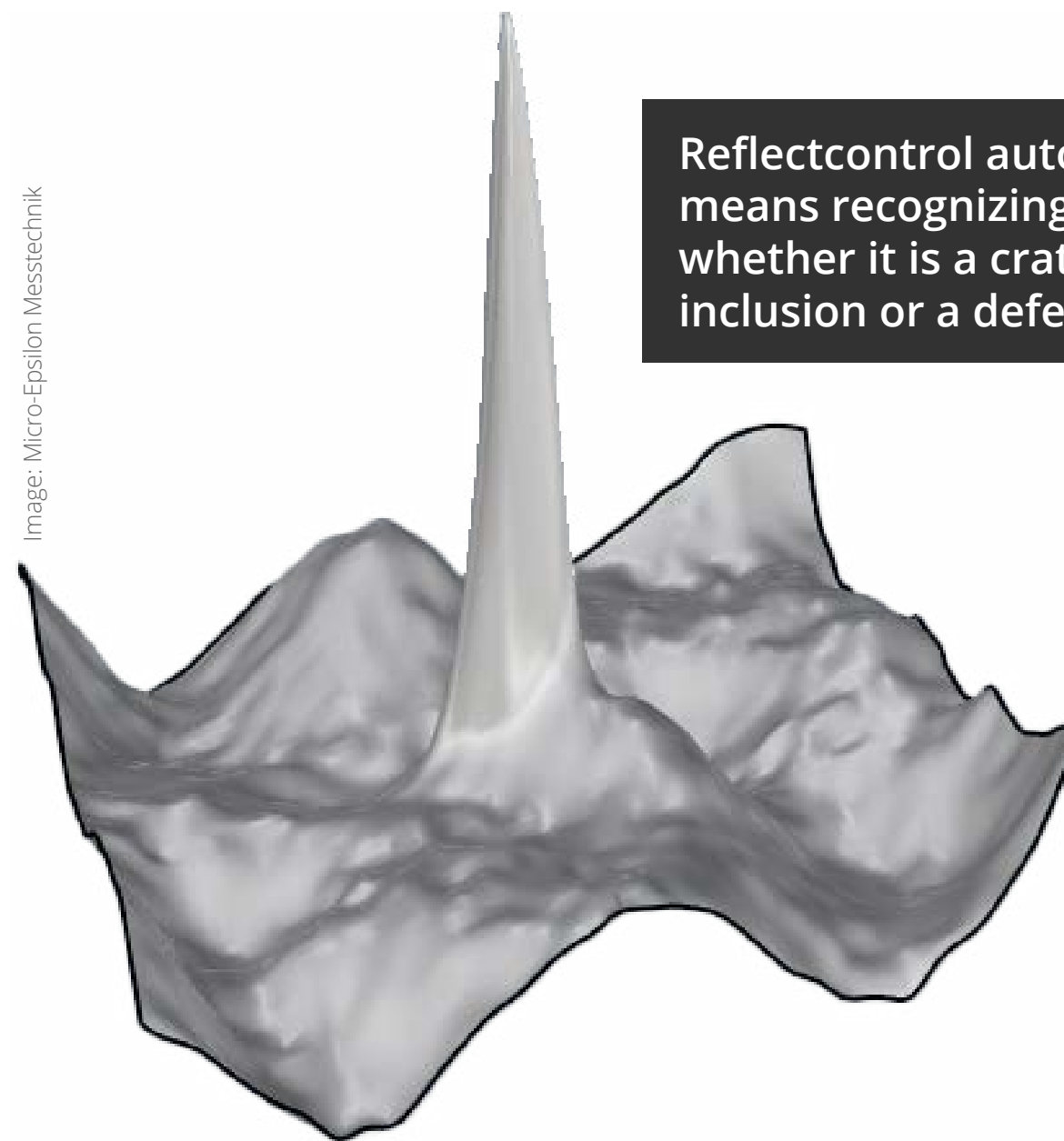
With the reflectcontrol system, the body is brought into a fixed position. The sensors are attached to robotic arms and move across the bodywork. Micro-Epsilon opted for this method because it achieves the lowest error rate and the required cycle times can be met. Two to four robot arms, each with a sensor, work at each inspection station—allowing the entire body to be measured.

In order to accelerate and decelerate the robot arm sufficiently, it was necessary to keep the total weight of a sensor below 50 kg (about 110 lb), which Micro-Epsilon achieved using a carbon housing. This also increases the robustness of the overall system and protects the robot arm.

With the light tunnels described above, car manufacturers achieved a defect coverage of around 60 percent in the past. With reflectcontrol, fault coverage of almost 100 percent is possible.

Automatic Processing of Defects

First, the vehicle is measured from one measuring position to the next and any defects found are projected back onto the vehicle surface. A defect can be localized at ± 3 mm (about 0.12 in) on the vehicle surface. 3D features such as height, depth and volume are added to each defect using



Reflectcontrol automotive can classify defects. This means recognizing the type of defect, for example, whether it is a crater as shown in the picture, an inclusion or a defect from the subsurface.

3D reconstruction. All collected data is saved in an XML file and is thus available to the vehicle manufacturer.

Once the defect has been detected and localized, automatic processing can begin, which Micro-Epsilon implements together with its partner companies Asis and Virtek Vision. This is done using additional robots with active force control, each equipped with a dual-mounted sanding and polishing head. A robot first grinds off the defect and then polishes it. Used sanding sheets and polishing sponges are removed at changing stations and new ones are picked up. Using a laser marking system from Virtek Vision, the defect is then marked as machined without contact by projecting light onto the body. If required, additional defects can be displayed via the projection, which must be reworked manually. The system knows

at all times which robot is currently processing which points.

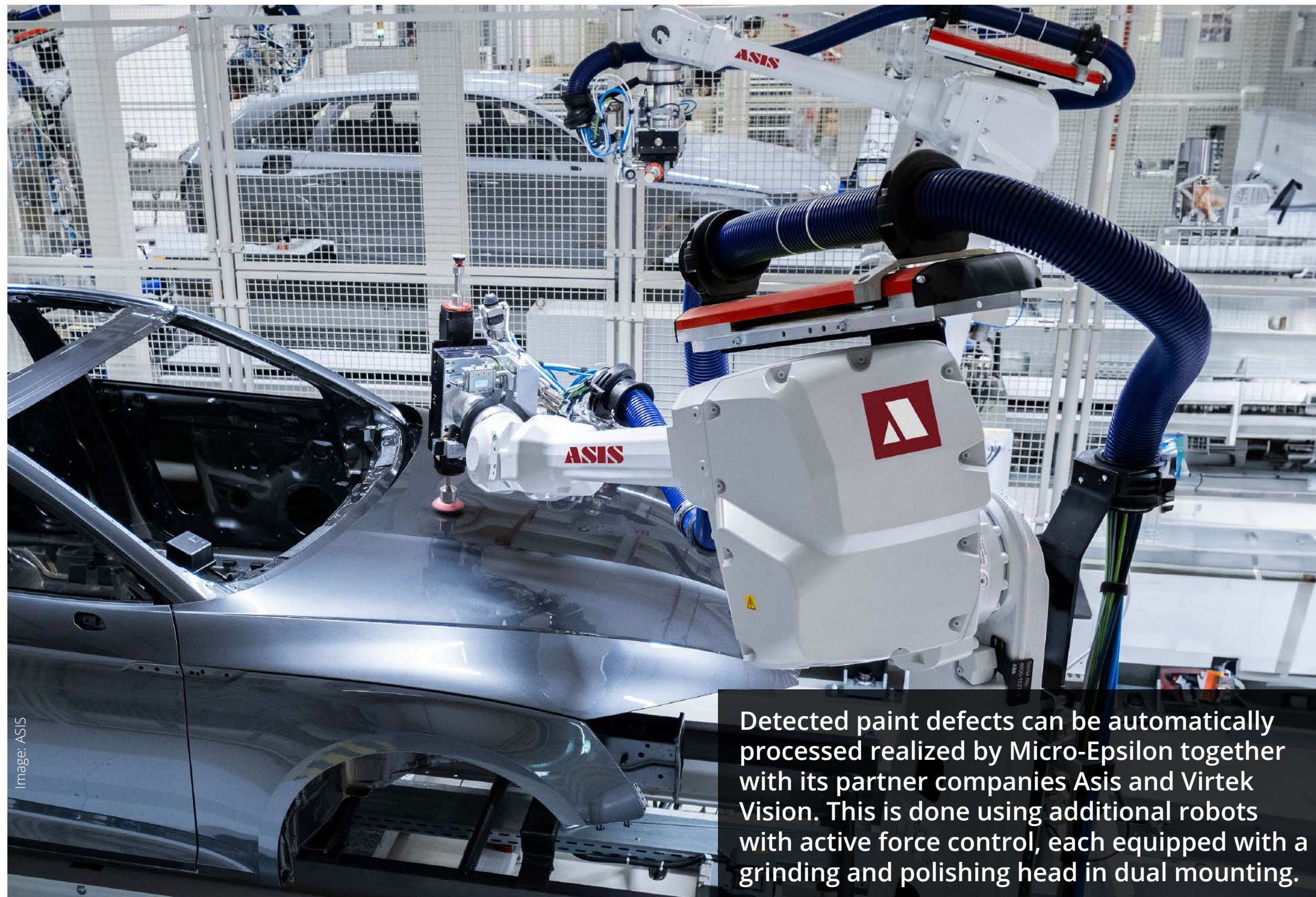
The most important prerequisite for automatic processing is the database that Micro-Epsilon can provide with reflectcontrol. This enables OEMs to optimize their production, identify error chains and intervene at an early stage if errors occur.

System Learns Automatically

The detailed database also benefits the classification of [3D data](#). Defect detection results in a 3D reconstruction—in principle, it is based on the integration of the curvature data. It is sufficient to reconstruct in the vicinity of the defect.

The system can independently define new defect classes. Due to the large database, the system can be used for audits. The labeled data trains also the underlying AI algorithms.

All data is also available to the OEM in a file and can be read into the standard higher-level Q systems. This means that the data can be visualized using established tools. The system learns from all the data it collects and therefore becomes increasingly intelligent. This can also be used to set up early warning systems to detect and eliminate error chains at an early stage. For example, warning thresholds can be created when certain numbers of defects are exceeded. In addition, so-called heat maps can be used to find error hotspots.



Evaluating the Surface Structure

In addition to automatic processing, Micro-Epsilon can perform an appearance evaluation. For a structural evaluation of the surface, the existing paint structure is broken down into its spectral components. The components are summarized in different frequency ranges, for example, which short and long waves are contained in the structure of the surface, because no surface is perfectly smooth.

It is important for car manufacturers to maintain certain appearance values on a car body. Automated cells, end-of-line cells or aqua cells, are normally used for this purpose. A vehicle is inserted into this and viewed by a robot with a scanner. The robot moves to the various positions and measures the appearance directly over the surface.

This takes about 20 minutes in total – so a maximum of three vehicles can be measured per hour. With the system from Micro-Epsilon, the appear-

ance can be evaluated on the basis of the existing images without additional hardware. This saves time and costs for the OEM.

Extensive Database

Another important innovation is the classification of data. This can be used to automate the processing of errors. Classification means recognizing the type of defect, for example, whether it is a crater, an inclusion or a defect from the subsurface. The customer also has access to 3D data–so they can access the exact dimensions of the defect at any time and initiate extensive analyses. As all data can be transferred to the company's internal Q-System, alarm functions can be set up and faults communicated at the appropriate point.

Conclusion

With Micro-Epsilon reflectcontrol, defects in reflective surfaces can be detected and classified almost 100 percent. The system is superior to conventional light tunnels and static systems, particularly in the field of paint defect inspection in automotive production. Due to the large database, the manufacturers of automatic processing systems are able to assign the correct processing recipes to the defects. This reduces unnecessary defect handling and thus saves resources and costs. ■

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S. 45

Efficient 3D Inline Inspection in Battery Production
Micro-Epsilon



S. 46

Revolutionizing Precision Measurement with Advanced Technology
Mitutoyo



S. 46

Advancing Process Automation with Enhanced Connectivity
Optris



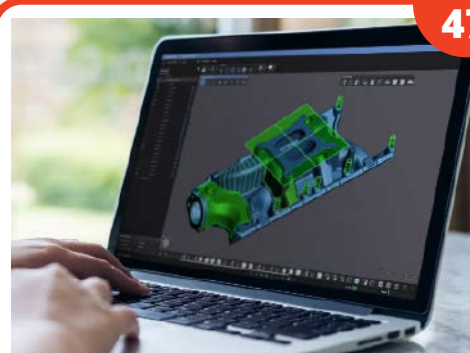
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Manufacturing Technologies Unveiled
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Advancements in Robot-Assisted 3D Inspection
Zebra Technologies



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Streamlining Reverse Engineering with Advanced 3D Scan Software
Creaform



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Innovative Modular Lighting Solution for Machine Vision
Advanced Illumination



Image: Micro-Epsilon

Efficient 3D Inline Inspection in Battery Production

In battery production, accurate measurement of terminal components is crucial. The Surfacecontrol 3D snapshot sensor from [Micro-Epsilon](#) is employed for inline coplanarity inspection of pole terminals, shunts, and bridges. Integrated directly into the production line at the rotary indexing table, this sensor generates a precise 3D point cloud within milliseconds. These data are transmitted via gigabit ethernet to proprietary software for processing and coplanarity calculation. The Surfacecontrol 3500-80, positioned orthogonally to the measurement object, offers high data quality for precise results. Its compact, inline-capable design eliminates the need for an additional controller, saving space and costs. The sensor's field of view of 80 x 50 mm (about 3 x 2 inches) facilitates efficient measurement, ensuring the accuracy required in battery production.

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April 16, 2025:

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Revolutionizing Precision Measurement with Advanced Technology

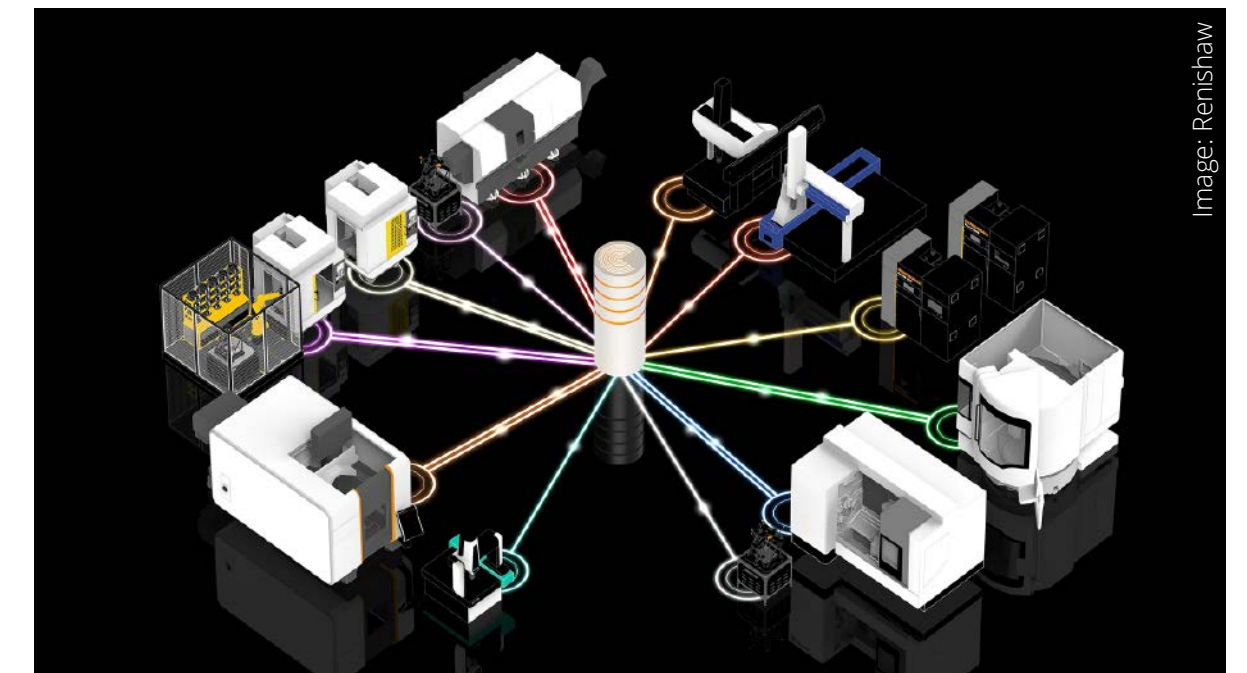
The FTA-H3000 from [Mitutoyo](#)'s Formtracer Avant series combines both functions in a single device for accuracy and efficiency. Traditionally, separate devices were needed for roughness and contour analysis, but the FTA-H3000 integrates them, reducing operator error and boosting productivity. This model features a greatly expanded measurement range ($Z1 = 16 \text{ mm}$), offering 3.2 times the capacity of its predecessor, allowing for precise measurement of workpieces with significant height variations. The FTA-H3000's precision is underscored by its Z1-axis accuracy of $(0.5+0.02H) \mu\text{m}$ and low noise level, ensuring reliable data in compliance with DIN EN ISO 21920 standards. The device supports easy probe exchange and accommodates various geometries for diverse measurement needs. Existing Avant customers benefit from seamless retrofitting options, enabling quick detector swaps and minimizing downtime, thus extending the equipment's lifespan while integrating the latest technological advancements.

 **AUTOMATE Booth #5218**



Advancing Process Automation with Enhanced Connectivity

[Optris](#) has introduced new digital interfaces for its infrared temperature measurement devices, enabling seamless integration into industrial automation systems. The latest pyrometer models from the CT, CT Laser, CT Ratio, and CS Vision series, along with Ethernet-based infrared cameras from the Xi series, now support industry protocols like Profinet, Ethernet/IP, Ethernet TCP/IP, and Modbus TCP. These interfaces ensure reliable real-time temperature data transmission, enhancing process control and monitoring. The robust industrial Ethernet interface modules feature IP67 protection and are easily installed using standardized network cables. Separate interface boxes are available for CS Vision and Xi series devices, with various cable lengths for adaptable installation. Preconfigured EDS and GSD files simplify device implementation, reducing integration effort. These advancements allow precise and flexible integration of Optris devices into industrial processes, optimizing control, minimizing downtime, and increasing production efficiency.



Manufacturing Technologies Unveiled

[Renishaw](#) presented a suite of manufacturing technologies at IMTS 2024, emphasizing improved performance and automation. Highlights include Renishaw Central, a smart data platform for manufacturing connectivity, and the Tempus technology for metal additive manufacturing, which reduces build times by up to 50 percent. The company's new product line for industrial robotics aims to simplify the setup and maintenance of robots. Renishaw will also showcase the Revo 5-axis multi-sensor system for CMMs, offering versatile inspection capabilities, and the RMP24-micro, the world's smallest wireless machine tool probe. Additionally, the latest Carto software suite update supports the XM-60 multi-axis calibrator for precision monitoring. Renishaw's solutions aim to address manufacturing challenges, enhance automation, and support sustainability without compromising speed, accuracy, or flexibility. These innovations demonstrate the role of advanced technologies in the future of manufacturing across various industries.

 **AUTOMATE Booth #432**



Image: Zebra Technologies

Advancements in Robot-Assisted 3D Inspection

At Automate 2025 in Detroit, [Senswork](#) and [Photoneo](#), now part of [Zebra Technologies](#), will unveil an advanced robot-assisted 3D inspection and measurement system designed for real-time quality control in manufacturing. The automated inspection cell uses collaborative robotics and advanced 3D vision to detect defects and perform precise 3D measurements directly on the production line. Visitors at booth 641 can witness the system's capabilities, which include real-time defect detection, GD&T-compliant 3D metrology for tight tolerance manufacturing, and seamless production integration for continuous automated quality control. Roman Rieger, CEO of Senswork, highlights the system's ability to conduct 3D measurements and detect surface defects directly on the production line, offering a robust solution for automated quality control. Frenišek Takáč from Photoneo emphasizes the collaboration's role in achieving unprecedented accuracy and optimizing quality control processes with greater efficiency.

 **AUTOMATE Booth #3207 (Zebra)**
Booth #641 (Senswork)

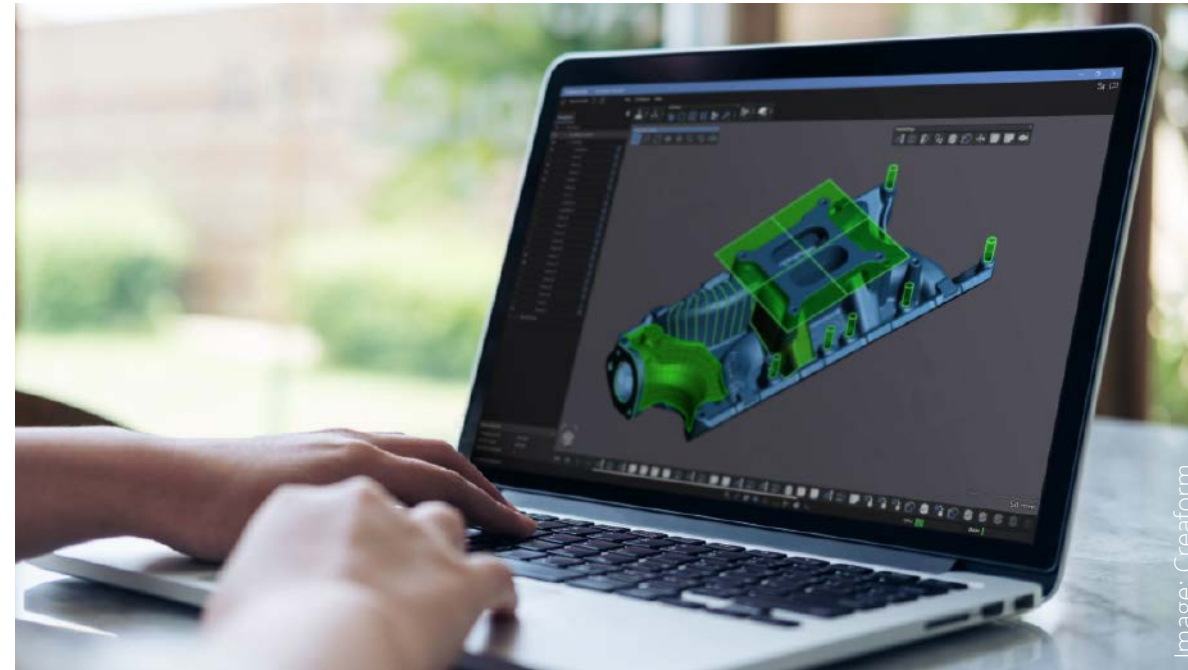


Image: Creaform

Streamlining Reverse Engineering with Advanced 3D Scan Software

[Creaform](#) has introduced Scan-to-CAD Pro, a new application module within the Creaform Metrology Suite, designed to enhance reverse engineering workflows. The software simplifies the conversion of 3D scan data into detailed CAD models. The module offers advanced algorithms for mesh extraction, flexible alignment, and optimized mesh editing tools, allowing professionals to choose the best fit for their workflow. Scan-to-CAD Pro includes superior features like 2D sketching and 3D modeling tools, acting as a seamless bridge between 3D scanning and CAD software, such as SolidWorks. This innovation accelerates the design process, reducing the need for multiple design iterations, especially in complex geometries. Creaform's solution eliminates the back-and-forth between scanning and CAD, speeding up time to market.

 **AUTOMATE Booth #5620**



Image: Flir

Innovative Multispectral Imaging Solution Revolutionizes Research

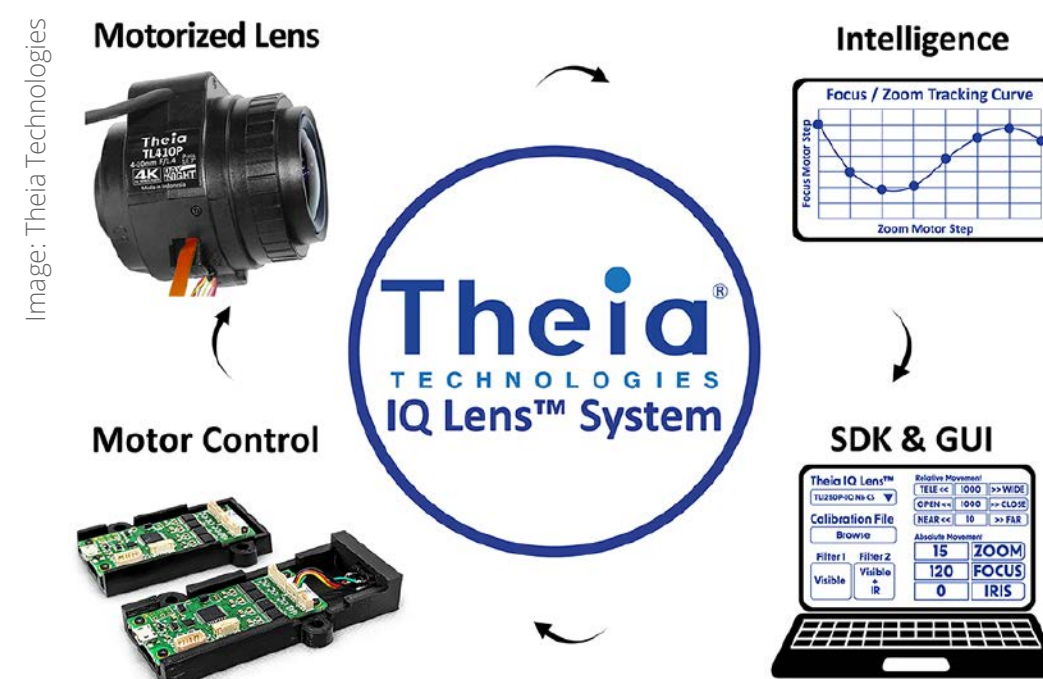
[Flir](#) has launched the Mix Startset. These synchronize thermal and visible light images at high speed for improved clarity in defense, commercial, and academic research. These advanced multispectral imaging solutions allow researchers to analyze and interpret complex thermal environments with greater precision. Previously, researchers faced challenges in aligning and synchronizing thermal and visible images, resulting in incomplete data. Mix overcomes this by capturing up to 1,004 images per second, providing a comprehensive view of high-speed events. The Startsets include the Flir Mix X-Series, optimized for high-speed research applications, and the A-Series, designed for electronics and renewable energy applications. The Flir Mix Toolkit aids researchers in post-processing by synchronizing thermal and visible images in real-time, simplifying analysis and accelerating discoveries. This user-friendly solution offers precise spatial alignment with radiometric data, providing detailed temperature insights across images.

 **AUTOMATE Booth #3239 (Teledyne)**



High-Resolution Cameras with Advanced Sony Sensors for Precision Imaging

[Ximea](#) introduces new models in the XIX-XL family, featuring medium format 4.1 inch Sony IMX811 sensors, offering the highest resolution with 245.7 Mpix. These cameras utilize backside illuminated (BSI) technology, achieving over 80% quantum efficiency for superior image quality, even in low light. Key features include a PCIe Gen 3 interface for real-time data transfer with low latency, supporting demanding applications like surface inspection and city mapping. The MX2457 models deliver 19,200 x 12,800 pixel resolution, transferring over 10 frames per second via a 32 Gbits high-speed interface. Despite the large sensor size, the compact 80 x 80 mm design facilitates easy integration. The detachable sensor head reduces noise and heat, enhancing image quality in tight spaces. Cooling options include a fan module and optional liquid cooling. Various lens mounts, including mechanical M72 and active EF, provide flexibility in aperture, focus, and stabilization control.



Advanced 4K Multi-Spectral Lens System Enhances Versatile Applications

[Theia Technologies](#) expands its lens system series with new 4K resolution, multi-spectral lenses. These motorized 4-10mm varifocal lenses provide 300 lp/mm resolution in both visible and NIR light, featuring motorized zoom and focus with optional NIR filters. Designed for flexible applications, they support factory automation, mobile logistics, agricultural monitoring, and law enforcement. The system includes a Python-based SDK and a user-friendly GUI, simplifying development and reducing costs. The calibration data optimizes image quality by addressing focus/zoom curves, geometrical distortion, and illumination. The motor control board supports USB, UART, or I2C protocols, and the purchase includes a royalty-free software license. This high-performance system enhances AI applications, offering a cost-effective and intelligent solution that accelerates time to market.

 **AUTOMATE Booth #3848**



Enhanced Imaging Capabilities with New High-Resolution Cameras

[JAi](#) has expanded its Sweep Series with four new 4K bilinear and monochrome camera models, featuring 5 GigE and CoaXPress interfaces. These cameras boast a 4096-pixel resolution on a 14.3 mm-wide sensor, with pixel sizes of 3.5 μm x 3. μm . Bilinear models achieve scan rates up to 42 kHz, while monochrome models reach up to 84 kHz, making them ideal for precision-demanding applications like battery inspection, food sorting, and waste management. The cameras utilize advanced integrated sensors for exceptional precision, employing minimal spatial compensation and FPGA-based binning technology to enhance sensitivity and image quality in low-light and high-speed environments. The new models minimize keystone and spatial compensation needs and offer full-resolution color channels through pixel interpolation. Available with 5GigE and CoaXPress interfaces, these compact cameras are easily integrated into existing systems and support C-Mount lenses, providing flexibility for various imaging applications.

 **AUTOMATE Booth #5600**



Enhanced Integration in Machine Vision Software

MVTec's latest release, Merlic 5.7, focuses on simplifying the integration of machine vision software into machine control systems, addressing the growing need for intuitive, non-programmer-friendly solutions in industrial automation. The new version enhances the usability of the Merlic Runtime Environment (RTE) and optimizes communication interfaces. By streamlining the integration process, the need for additional processes is eliminated, improving usability and deployment. Two RTE instances can now run in parallel without manual port configuration, and plugin messages are logged directly, simplifying debugging. Merlic's frontend is now available for Linux, allowing visualization of processing results on Linux systems, and can operate as a remote frontend, offering flexible system architecture. Version 5.7 includes example Dockerfiles and scripts for containerized deployment, facilitating seamless integration into existing workflows and enhancing flexibility in application management.

 **AUTOMATE Booth #5207**



Camera Technology Enhances Motion Capture

IDS Imaging Development Systems introduces the Ueye EVS, a camera series featuring an event-based vision sensor designed for efficient capture of fast-moving objects without motion blur and reduced data volume. Unlike traditional systems, the Ueye EVS records only significant events, minimizing data generation and optimizing high-speed applications like vibration monitoring. The compact USB3 camera uses the Sony/Prophesee IMX636 sensor, which reacts solely to changes in the scene, achieving temporal resolutions of under 100 microseconds. This allows for capturing rapid movements without information loss, akin to a frame rate exceeding 10,000 frames per second. By ignoring static areas, the sensor reduces data output by 10 to 1000 times, saving storage and processing resources. The camera series, starting with the Ueye XCP-E, offers this technology in a compact industrial format, suitable for various applications.

 **AUTOMATE Booth #6000**



Comprehensive Protection for Imaging Technology

At the [Control trade fair](#), [Autovimation](#) presents its range of solutions for effectively protecting imaging technology as part of the [Fraunhofer Alliance's Vision Special Show](#). The company's diverse housing series not only achieve high IP protection ratings but also passively cool installed components by up to 25 K. For environments with extreme temperatures, Autovimation offers powerful, cost-efficient climate control technology. The range includes housings in various sizes and formats for all common camera types, including industrial-grade protective housings and hygienic design housings suitable for high-pressure cleaning in food and pharmaceutical industries. The Chameleon M, a new hygienic housing for right-angle cameras, makes its debut at the fair. Exhibits demonstrate robust installation kits for vision applications, including the Machine Vision Building Kit with aluminum dovetail profiles and the award-winning Hygienic Building Kit in EHEGD-compliant stainless steel. Accessories include various windows, wind curtains, protective covers, and the Meganova LED ring light with smart control. A display showcases the lighting's capabilities with sharp images of a fan rotating at 50 km/h.



Image: Lucid Vision Labs

Enhanced Precision with New 3D Camera Technology

[Lucid Vision Labs](#) has introduced the Helios 2 Narrow, expanding its 3D time-of-flight camera lineup. Featuring Sony's IMX556 DepthSense sensor, this camera provides real-time 3D point cloud data with high accuracy and minimized multipath interference. Its 31 x 24 degrees field of view enables precise depth measurements, ideal for applications requiring accuracy in confined spaces. The Helios 2 Narrow retains the robust IP67-rated design of the standard model, optimized for distances between 30 and 60 inches. Its compact design and user-friendly features make it popular for industrial settings needing exact measurements. Lucid's Arena SDK offers intuitive controls, enabling real-time scene visualization and adjustments. The cameras adhere to GigE Vision 2.0 and GenICam³ standards, supported by the Arena SDK compatible with multiple operating systems and programming languages, ensuring easy integration into existing systems.

 **AUTOMATE Booth #4844**

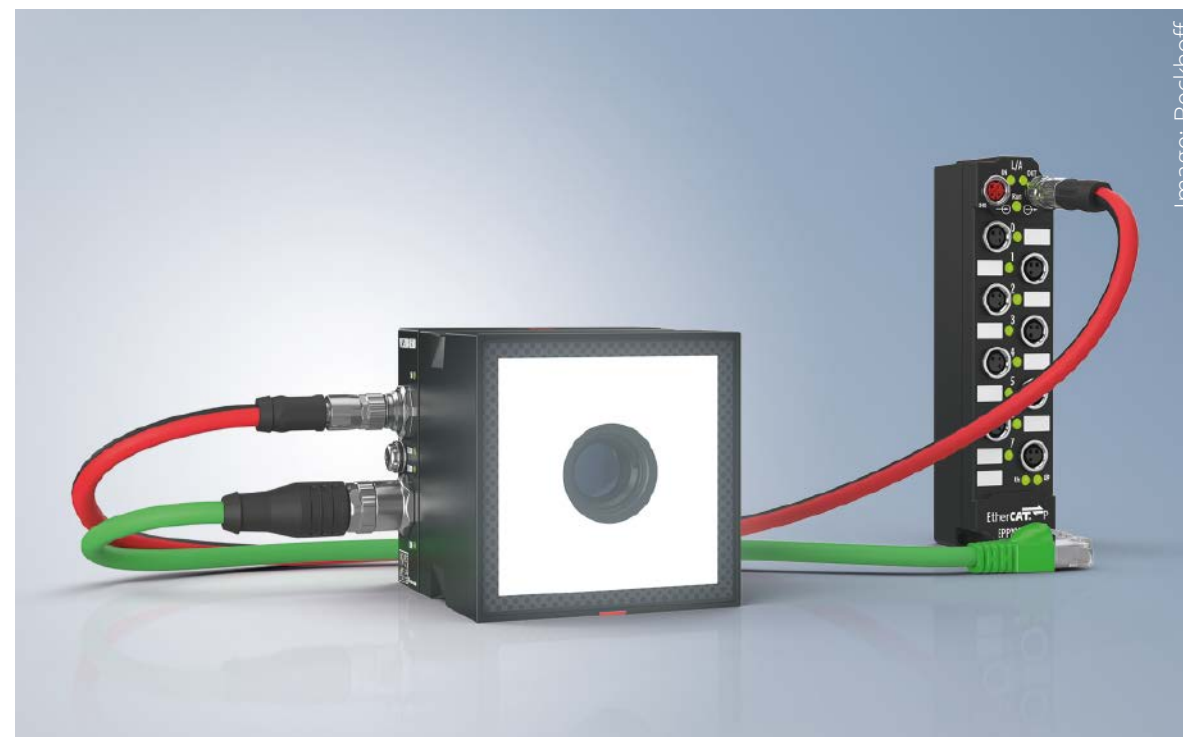


Image: Beckhoff

Efficient Integration with New Vision Units

[Beckhoff](#) expands its VUI2000 series with four new Vision Units, enhancing industrial image processing capabilities. The Vision Unit Illuminated (VUI) combines a camera, lighting, and focusable optics using liquid-lens technology, significantly reducing installation and startup efforts. All VUI components are housed in an aesthetically pleasing IP65/67-rated anodized aluminum casing. The new additions feature color or monochrome image sensors with resolutions of 2.3 MP and 3.1 MP and a 16 mm focal length. The liquid lens used in all VUIs eliminates mechanical parts, allowing precise focus adjustments based on real measurements thanks to factory calibration. Optimal lens position, aperture, and depth of field settings ensure sharp focus within a range of 10 to 2,000 mm, exceeding the lighting's optimal distance. Temperature-induced refractive changes are reliably compensated through continuous temperature measurement and a mathematical model.

 **AUTOMATE Booth #2400**



Image: SVS-Vistek

Innovative High-Speed Camera for Rapid Process Analysis

[SVS-Vistek](#) has expanded its Mikrotron Eosens high-speed camera series with the Eosens 9.5 model, capable of capturing over 200,000 frames per second depending on resolution settings. This camera opens new possibilities for analyzing extremely fast processes such as additive manufacturing, melt pool monitoring, grinding or milling, sports and entertainment applications, electronics production, and defense tasks. Featuring the Luxima LUX9506V3 sensor with 6.5 µm pixels, it offers global shutter capture for rapid events, adjustable by the user. At full resolution of 9.5 megapixels, it records 509 frames per second, while reducing the area of interest (AOI) to 1280 x 864 increases the rate to 4,240 frames per second. For ultra-fast applications, the AOI can be minimized further, achieving up to 71,581 frames per second at 128 x 128 pixels or 225,000 frames per second at 128 x 24 pixels. Data is transmitted via a robust CXP12 interface with four channels. Compatible with various lens types, the EoSens9.5 is ideal for analyzing rapid events across multiple industries.

 **AUTOMATE Booth #5403 (TKH Vision)**

Image: Advanced Illumination



Modular Lighting Solution for Machine Vision

[Advanced Illumination](#) has introduced the AL325 Series Modular Bar Lights. Traditional fixed-configuration lights often necessitate purchasing new units when requirements change, leading to higher costs and delays. The AL325 Series addresses these issues with a modular system featuring field-swappable lenses and light conditioning materials, allowing users to optimize configurations directly on-site. This reduces setup time and inventory needs. The series boasts high-performance LEDs, efficient TIR lenses, and superior thermal management, offering nearly double the brightness of competitors. It includes embedded control capabilities for easy operation and an extrusion-based design adaptable to various sizes. Extensive customization options are available, including 16 wavelengths, multiple light conditioning choices, and five lens options. The series promises rapid deployment with build-to-order lead times of just one to two weeks.

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