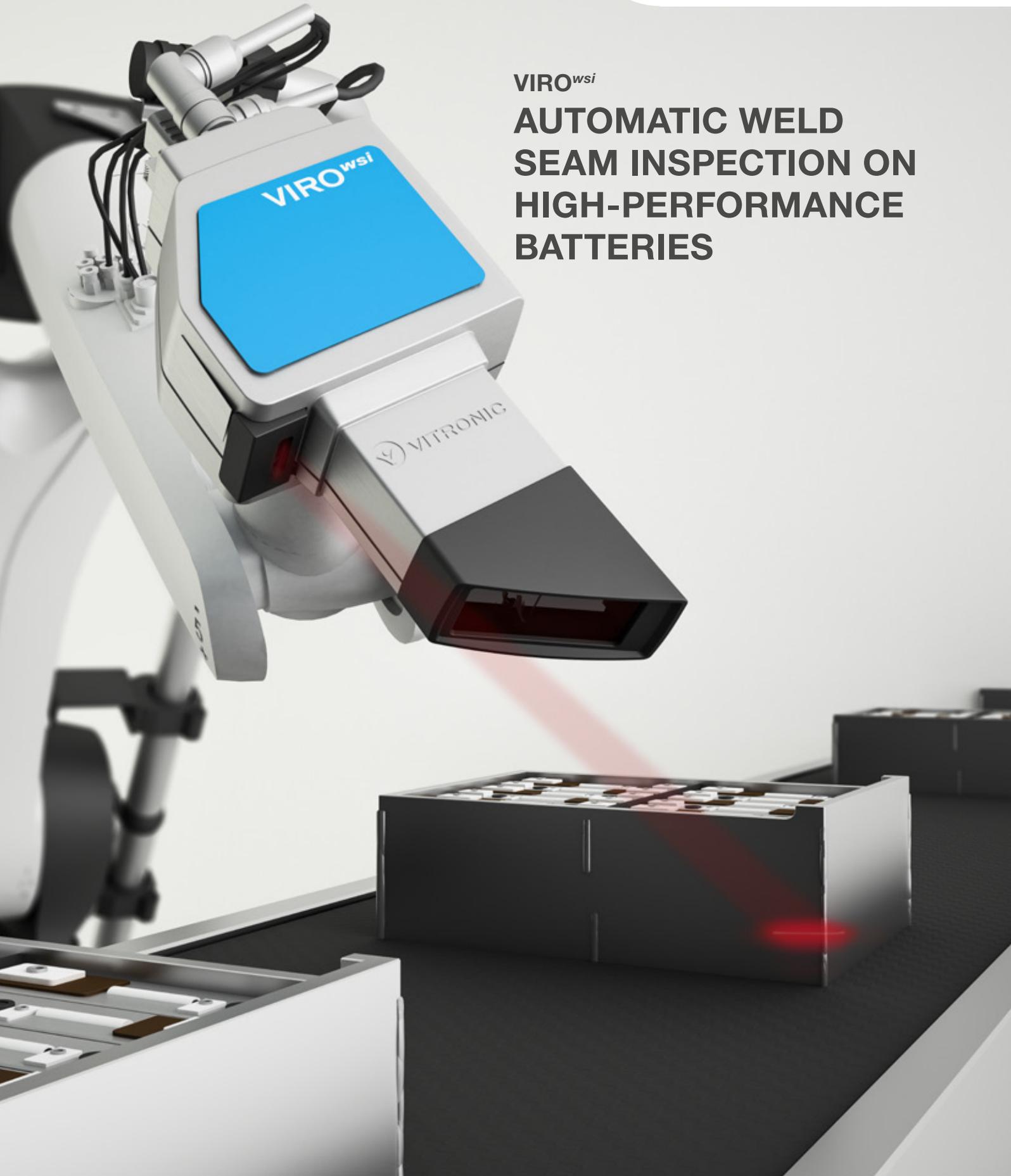
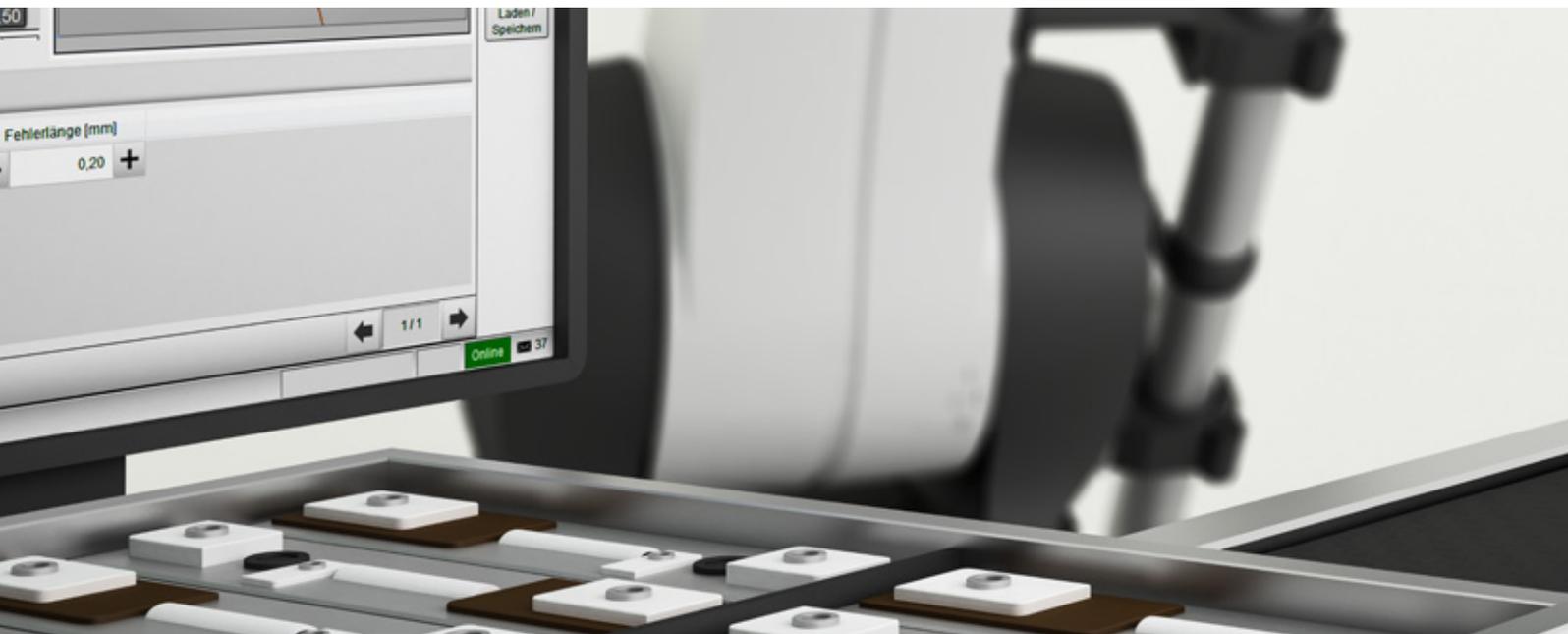




VITRONIC
the machine vision people

VIRO^{ws}i
**AUTOMATIC WELD
SEAM INSPECTION ON
HIGH-PERFORMANCE
BATTERIES**





Automatic Weld Seam Inspection on High-Performance Batteries for Electric Vehicles

A high-performance battery for use in electric vehicles needs to be extremely safe.

This demand can only be met by the highest quality standards. Optical inspection systems are a must, especially in safety-relevant areas such as weld seams. The camera based inspection system by VITRONIC comes with automatic inspection to ensure the quality of the weld seams is one hundred percent. This makes for stable processes and also helps to reduce production costs.

Quality and Safety Through Machine Vision

The suitability of a high-performance battery such as the lithium ion battery for use in electric vehicles depends on a number of technical, economic and ecological factors. A strong emphasis is placed on the topic of safety. A car fire caused by a battery constitutes a real threat to human life. Material damage and loss of reputation would also be very damaging for the automotive manufacturer. Additionally, safety is an important consideration when deciding on which car to buy¹. Lithium ion batteries fitted in electric cars must be capable of surviving an accident. Reliable quality inspections as part of the manufacturing process of high-performance batteries are indispensable in ensuring safe operation of electric vehicles.

Besides the safety issue, cost is an important aspect that also supports having reliable inline inspections. "Battery manufacturers want inline inspections after each production

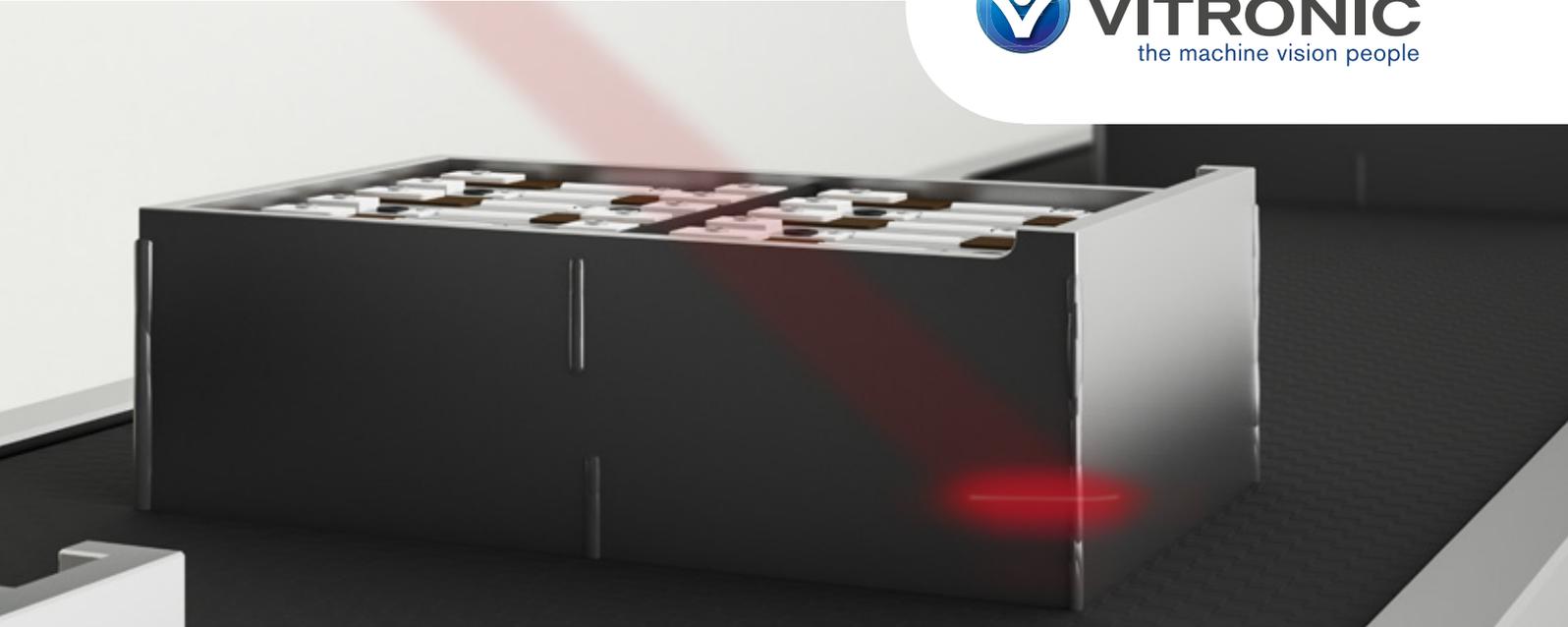
process for sensitive storage technologies, as the late detection of rejects is painfully expensive due to excessive material costs."²

While visual quality inspections by human eye are still standard practice, high production outputs like those found in the serial production of battery cells use mainly random sampling. Industrial machine vision systems offer solutions that meet the quality requirements of battery inspections through reliable and 100% testing. In addition to safety, readability at high speeds and the ability to integrate inspection systems in the production process constitute major advantages.

Optical inspection of safety-relevant weld seams on high-performance cells plays an important role in the safe and efficient production of high-performance batteries. An inline quality control with a camera-based technology means that defects at individual cells can be identified before further processing into packs and modules is initiated. Scrappage is significantly reduced which ultimately leads to a reduction in production costs.

Weld Seams Determine Safety

Several welding processes are part of the battery production process. At individual cell level, contact tags within one or



several cells are welded together, and the cells are electrically connected to form modules. Aluminum and copper are often welded together in the connection. This is a technologically demanding welding process.

Additionally, the cell casings and the entire modules are hermetically sealed through welding. This is the only way casings can withstand an internal pressure of 40 bar without damaging the surrounding cells. All seams must be flawless and homogeneous to ensure hermetic sealing without holes or cracks. Laser, arc and friction welding as well as soldering present different challenges to optical inspections. Camera-based inspection procedures can be seamlessly integrated in inline inspections and significantly speed up the inspection result. Defects at the delicate laser seams of a battery cell can be detected quickly and reliably via automated inspection. Minimal defects such as cracks and pores within the 1/100 mm area are of relevance here. Even the smallest deviations can influence the lifecycle of the battery and in turn impact safety.

Machine vision also ensures that no faulty components are used for further processing.

Detail and statistical evaluations are helpful for the continuous improvement of processes and can be used for process and plant optimization purposes.

Why Use VITRONIC for the Inspection of Weld Seams?

VITRONIC is the solution provider with relevant experience not only in the chassis and bodywork sector but also in the inspection of battery seams. The light-section based weld seam inspection system VIROwsI has proven its efficiency in hundreds of systems. The system works at high scanning speeds without impacting on line cycle time.

The new user-friendly software is of additional benefit. Its intuitive user interface allows for a speedy setup and configuration of test parameters. With the help of the database-supported evaluation tool and the real-time statistics function process, deviations can be detected early on. All information is immediately calculated into a view of real-time statistics. In parallel, it is stored in an integrated database where it is linked with component and seam IDs for subsequent tracking, evaluation, and statistics. That means that detailed inspection results and parameters are seamlessly documented. The VITRONIC solution provides an important contribution to automotive manufacturers, enabling them to fulfill their documentation and archiving requirements.

¹ Profile of international automotive buyers, press release, 20 January, 2015, European car barometer 2015

² White paper, Image processing in the automotive industry, World of Photonics 2015

VITRONIC Worldwide



VITRONIC is a global leader in the field of industrial machine vision headquartered in Wiesbaden, Germany. Since its foundation in 1984, the privately owned company has been offering highly innovative solutions in industrial automation, logistics and traffic technology. Today, VITRONIC supports customers in over 60 countries via a global network of subsidiaries, service centers and partner companies.

All of the companies' products are developed, designed and manufactured by VITRONIC in Germany. They range from standardized to fully customized solutions.

Feel free to contact us – we look forward to discussing your projects.

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