A Game Changer for In-Line Measuring Technology

At ZEISS, correlation-free measurements are considered a game changer because they will so fundamentally and permanently alter in-line measuring technology and ultimately the world of manufacturing. The global innovation not only enables automotive manufacturers to make measuring and production more efficient, but also brings them significantly closer to the Smart Factory of tomorrow.

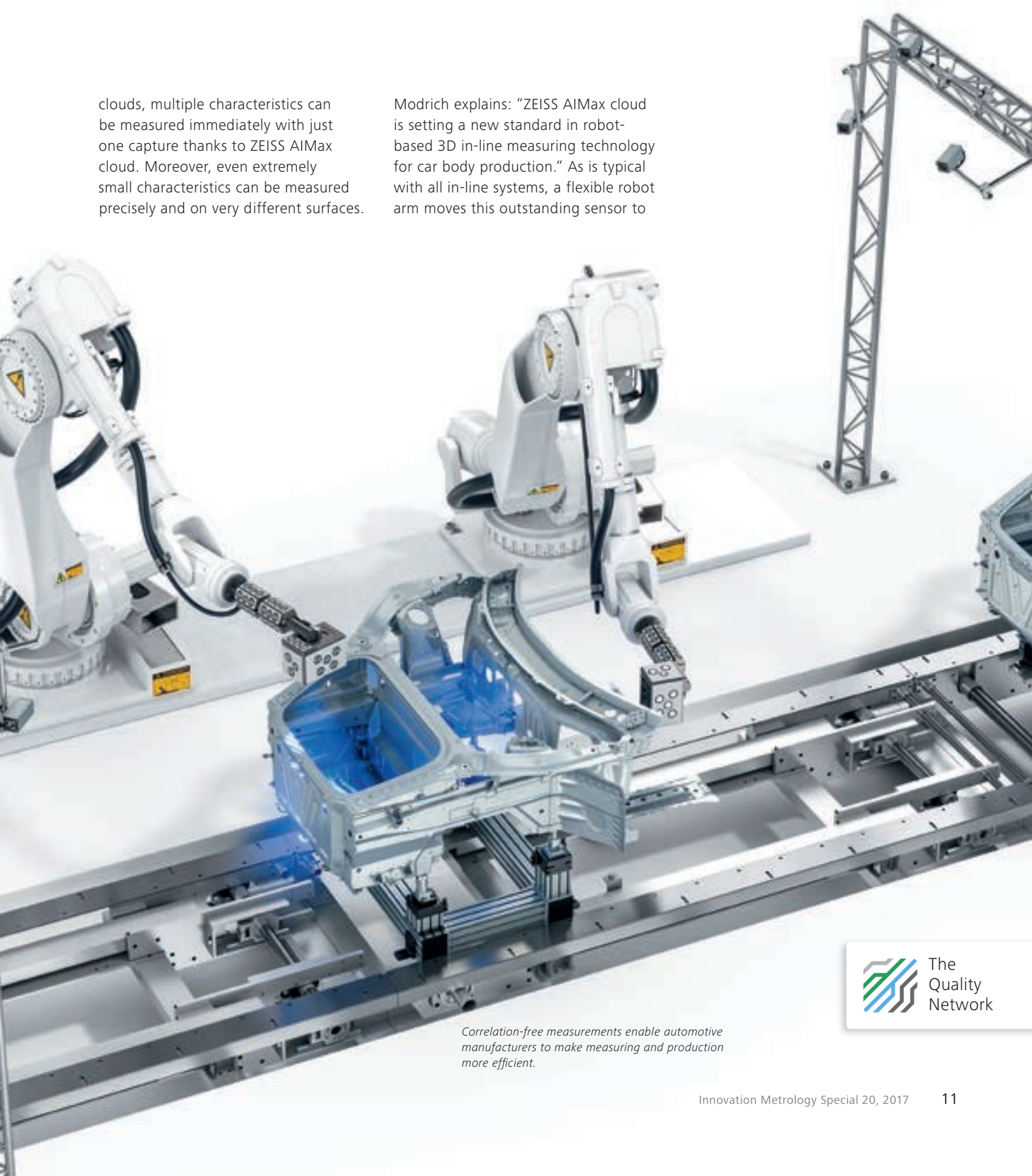
"Correlation-free measurements will provide an entirely new foundation for in-line measuring technology and boost manufacturing efficiency," says Dr. Kai-Udo Modrich, Head of Carl Zeiss Automated Inspection. To give you a better understanding of how automotive manufacturers benefit from using this technology, we decided to have a quick look at the world of in-line metrology solutions.

Dimensional accuracy – the be all and end all in manufacturing

Automotive manufacturers throughout the world monitor production using in-line measuring systems to meet their own high quality standards. These systems detect geometric deviations from defined characteristics and provide 100% inspection in the production cycle, enabling manufacturers to drastically reduce start up times, especially during product ramp-up. The speed and precision at which the geometry characteristics are inspected depend primarily on the optical sensors used. Last year, ZEISS impressed car body experts at the automatica trade fair with the ZEISS AIMax cloud sensor. This 3D sensor uses fringe projection to generate a point cloud in just a fraction of a second. In addition to the geometry characteristics which are already known, the new sensor design makes it possible to quickly and precisely capture characteristics which used to be difficult or even impossible to measure, such as rivets. By obtaining thick point

clouds, multiple characteristics can be measured immediately with just one capture thanks to ZEISS AIMax cloud. Moreover, even extremely small characteristics can be measured precisely and on very different surfaces.

Modrich explains: "ZEISS AIMax cloud is setting a new standard in robot-based 3D in-line measuring technology for car body production." As is typical with all in-line systems, a flexible robot arm moves this outstanding sensor to



Correlation-free measurements enable automotive manufacturers to make measuring and production more efficient.

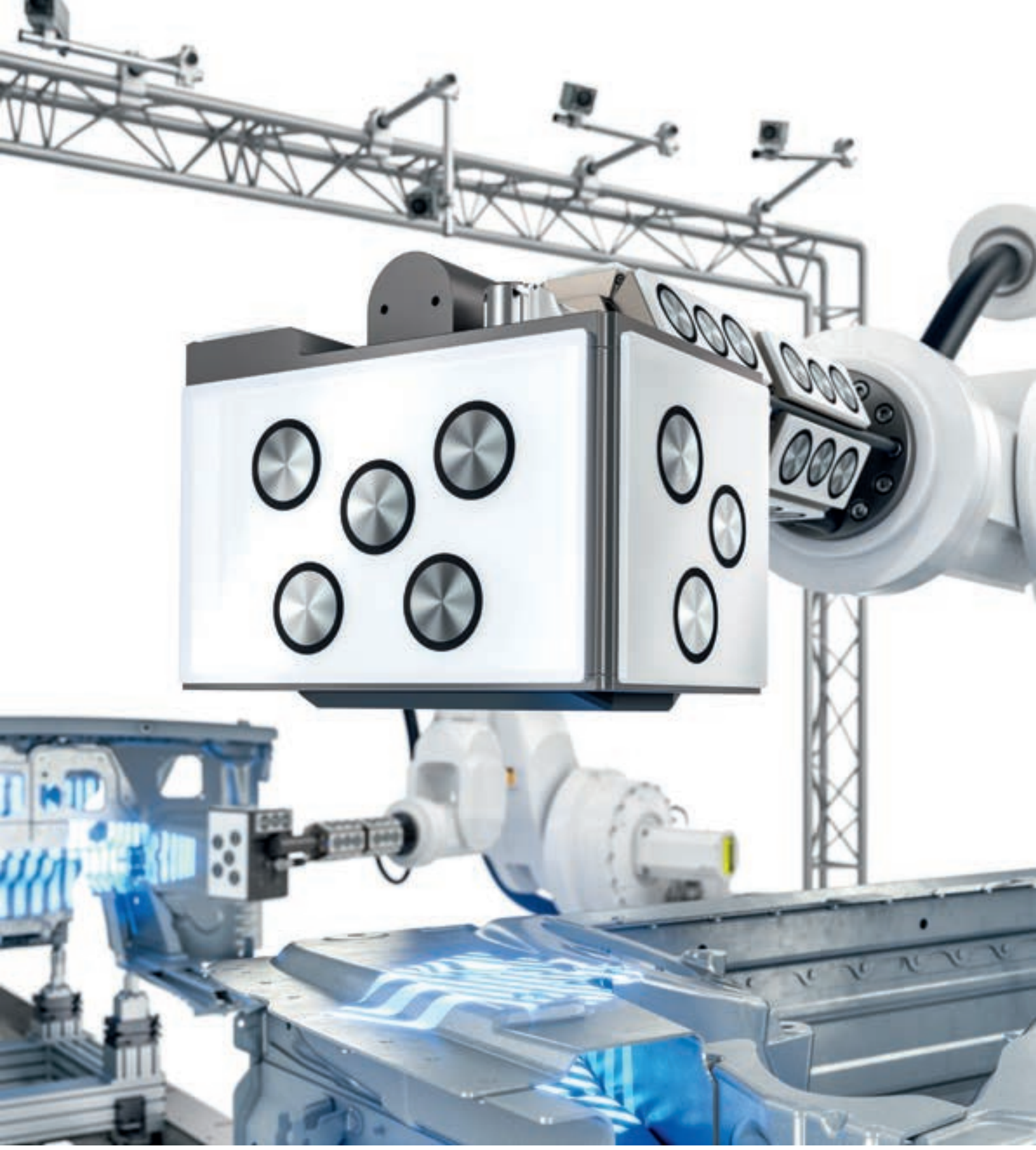
The Quality Network

The production floor cameras capture both the exact position of the robot as well as their own location, providing inherent self-monitoring for the entire measuring system.

the corresponding characteristics on the individual car body components. This method ensures that the entire measuring system provides accurate results, and no subsequent measurements are necessary. With traditional in-line measuring systems, reference measurements are performed on artifacts to ensure reliable repeat accuracy. Active compensation is necessary for the robot arm extension because of self-heating and changing ambient temperatures. As robot measurements typically have minimal absolute precision, the determined measurement values are usually offset by performing a comparison measurement on a coordinate measuring machine (CMM). The correlation is then checked using multiple measurements. Modrich sees the additional CMM workload in the measuring lab as a problem.

Reliability starting with the very first part

ZEISS developed correlation-free measuring to ensure that component dimensions are measured reliably, beginning with the very first part. This system uses standard cameras to detect the robots' deviation from their specified position, which can be caused by the aforementioned temperature influences. These cameras are installed above the in-line cell and track every movement of the ZEISS AIMax cloud sensor without any difficulty. There are markers on the robot arms and on the base of the in-line cell so that the system can determine the absolute position of the sensors in the space. Thanks to this information and, most importantly, intelligent algorithms, the software developed by ZEISS detects deviations from the standard state and immediately filters these out. With this system, companies must no longer subsequently measure their car body components on a highly precise CMM at regular intervals, and then transfer the identified discrepancies between the in-line and CMM measurements to the in-line measuring systems as correction values. “Now manufacturers can be sure that the measured values are correct, beginning with the very first part,” says Modrich. “Having spoken with many different customers, I know that car makers have been eagerly awaiting this development, because the benefits are obvious: companies significantly expedite the ramp-up times for manufacturing new models and achieve the desired move rate more quickly. And that means real savings.” For this Smart Production expert, this is only the most obvious benefit. Since the system already delivers reliable data beginning with the first part, it lays the foundation for implementing a closed production loop between the in-line measuring station and, for example, the welding robot. The software developers



The ZEISS AIMax cloud 3D sensor measures characteristics which are difficult to evaluate, such as rivets, nuts behind sheet metal and characteristic design lines – all with great accuracy and in a fraction of a second.

The numerous coded markers feature integrated background illumination, ensuring the location and position of the 3D sensor are precisely identified, even in a rough production environment.

are still working on incorporating the know-how employees have acquired from years of experience, but for Modrich this is only a matter of time. "The day will come when the in-line measurement data will directly control the manufacturing machines."