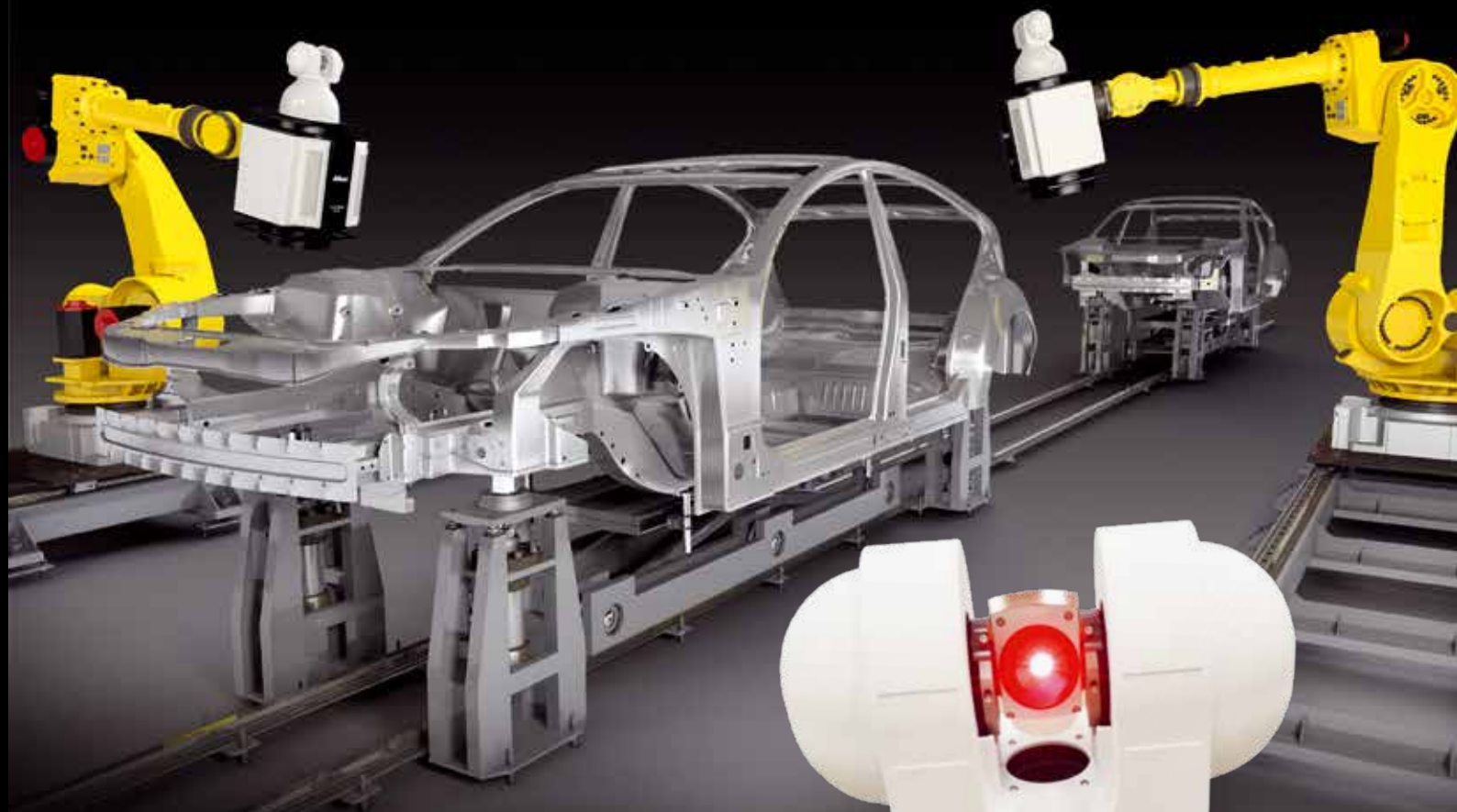




# LASER RADAR NEXT-GENERATION SHOPFLOOR CMM



**FLEXIBLE INSPECTION,  
UNBEATABLE PRODUCTIVITY**



**NIKON METROLOGY** | VISION BEYOND PRECISION

# INNOVATING SHOPFLOOR INSPECTION



**There is an increasing importance for automotive assembly plants to continuously monitor process quality throughout the production process. This need is driven by OEMs pushing the limits of design by using complex shapes, new materials, and cutting edge processes. Locations of holes, slots, studs, and welding lines along with flush & gap of doors, hoods, deck lids, and other hangers need to be measured and monitored throughout the assembly process. These inspections ensure that vehicles are built within the ever more stringent tolerances set by automotive manufacturers.**

Nikon Metrology – in close cooperation with key automotive OEM and integration partners- addresses these challenges by introducing an innovative approach to body-in-white (BIW) inspection based upon its non-contact Laser Radar system. Unlike a horizontal-arm CMM, the Laser Radar high-speed measurements fit within short production cycle times. The new MV331/351 Laser Radar doubles surface scanning speed and drastically increases feature measurement performance. New usability features such as an integrated robot mount, removable air filters and positive air pressurization make the system even better suited for robotized inspection on the shop floor.

## **Traditional body-in-white inspection is under pressure**

In the recent past body-in-white measurements have been performed in two phases - on the production line with low accuracy sensors to monitor process and in a CMM room where a sample of parts are sent to be inspected offline by large horizontal arm CMMs for more accurate measurements and to correlate the data from the inline sensors.

Although CMMs can provide highly accurate absolute measurements, they tend to be slow and require an expensive, dedicated metrology room. Vehicles need to be removed from the production line and then taken to the metrology room, manually fixtured and aligned



■ Flush and gap measurement on finished vehicle

# LASER RADAR IMPROVES SPEED AND QUALITY



■ Features such as holes, slots, pins, studs can be quickly inspected using the Laser Radar

to the CMM. The CMM then starts its measurement process, which is also very time-consuming. Taking into account the setup and measurement time, at best two vehicles can be inspected per shift on a CMM, but often only one vehicle is measured. This is a very small sample considering that over 1,000 vehicles of various styles can be built each day on a single production line. This is certainly not a large enough sample to monitor the production process.

Inline systems typically measure every vehicle but can require over 100 individual fixed sensors to inspect the required features. Although these sensors are very quick to measure, they are demanding to install and maintain. Also they do not provide measurements directly



■ In each robot position, the Laser Radar can inspect dozens of features

in the car's coordinate system. In addition, most assembly lines now are 'flexible', meaning that they can produce more than one type of vehicle. Fixed sensors cannot be used across different vehicle styles; every vehicle requires its own custom set of sensors making them even more expensive and onerous to maintain.

Recently inline inspection systems have been moving towards robotic based solutions which are flexible, but rely on the robot's positional precision which limits the overall accuracy. These systems typically have four or more robots with a sensor located on the end effector of each robot that is re-positioned to measure each of the features that need to be inspected. Hundreds of locations need to be programmed making them time-consuming to set up, difficult to maintain and they still do not provide the required accuracy and correlation to a CMM.

## A new approach: Flexible inspection, absolute measurement

Innovative inspection stations are being installed today, both lineside and in-line, by major automotive OEMs using Nikon Metrology's Laser Radar. The Laser Radar has been used for many years in the aerospace and renewable energy sectors and is now providing



## € WHAT CUSTOMERS GAIN

With the need for shorter and more flexible production cycles, automotive manufacturers are continuously looking to cut time and costs whilst maintaining quality. For automotive inline inspection, the automated Laser Radar on a robot offers the right capabilities to meet the need for flexible and absolute measurements directly on the shop floor. For car manufacturers this results in:

- ✓ **Shorter startup of new production line or upon vehicle model changes:** During the startup phase of a production line, the first produced vehicles can be completely measured and compared to CAD in a short time. This provides better insight into product conformance and enables faster finetuning of the production process.
- ✓ **Reduced scrap:** By closely monitoring the production quality, the manufacturing process can be instantly adjusted when variances occur over time.
- ✓ **Future proof data:** Measurements in absolute coordinates fit in the digital manufacturing process where big data is used as a reference to compare data over time and enabling enhanced insight, decision making, process automation and to speed up future product development.

# AUTOMATED, NON-CONTACT LARGE VOLUME INSPECTION

a unique alternative to the shortcomings of traditional automotive metrology systems like CMMs and inline sensor systems. The new MV331/351 Laser Radar is further optimized for car body shopfloor inspection. The Laser Radar's high speed vision scans at rates of 2.000 points per second – enables fast measurement of surfaces, sections and complex features.

The Laser Radar performs automated, highly accurate, contactless measurements in the car coordinate system by using a focused laser that is controlled by a precision azimuth and elevation system. The Laser Radar requires a fraction of the reflected signal to make accurate measurements, enabling it to inspect almost any material, color or surface texture, such as bare sheet metal, coated BIW or painted cars.

The measurement accuracy and repeatability of the Laser Radar is comparable to measurements taken with a traditional horizontal arm touch probe, while it is many times faster. Two Laser Radars working in parallel can measure 700 features on a BIW vehicle in less than one hour; this can take a full shift for traditional CMM.

The configuration of a Laser Radar inspection station can vary based on the specific needs of the OEM, but typically consists of one or more Laser Radars that are manipulated by 6-axis industrial robots. The industrial robots are used to automatically reposition the Laser Radar to enable it to inspect areas that are not visible from a single location.

After repositioning the robot, the Laser Radar automatically realigns to the part by measuring alignment (such as tooling balls) on the vehicle or tooling. Unlike other inline robotic measurement systems, this guarantees that all measurements are collected in the vehicle coordinate system and ensures feature accuracy is independent of the robots ability to accurately locate the Laser Radar.

Laser Radar has a spherical field-of-view, meaning it has visibility to large sections of the vehicle at any time and dozens of features on the vehicle can be measured from a single location. Just like a CMM, measurements are pre-programmed directly from the vehicle's CAD model using the inspection software. After the initial programming,

Laser Radar specifications	
Scan speed	Up to 2,000 pts/s
Range (Radius)	MV331: 1 to 30 m MV351: 1 to 50 m
Field-of-View	Az: 360° EL: +/- 45°
3D accuracy (2σ)	24 μm @ 2 m 102 μm @ 10 m 301 μm @ 30 m
Laser	Class II

	Inspection time*
Surface Point	< 0.5 s
Hole	< 2.5 s
Slot	< 3.5 s
Alignment Sphere	< 2.0 s

\*Approximate time, actual depends on feature size and software settings

data collection and reporting is fully automated. Specific inspection scripts can also be written for each vehicle style and model being built on the production line making the Laser Radar inspection station completely flexible for changes to inspection plans and even new vehicle styles. Changing the features to inspect or adding in new vehicle styles is completely software based and does not require any physical changes to the setup or new hardware.

The application software takes care of the interaction of the Laser Radar, robot, and data processing; inspections are completely automated and do not require manual intervention during runtime. As a conclusion, the automated Laser Radar has all capabilities to improve speed and quality of the measurements compared to the traditional methods. For customers this will result in faster go-to-market with new or updated models, reduced scrap and ownership of future-proof data.

Contact Nikon Metrology for more information.



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