Optimising and Validating on-CMM laser scanning technologies for automotive applications

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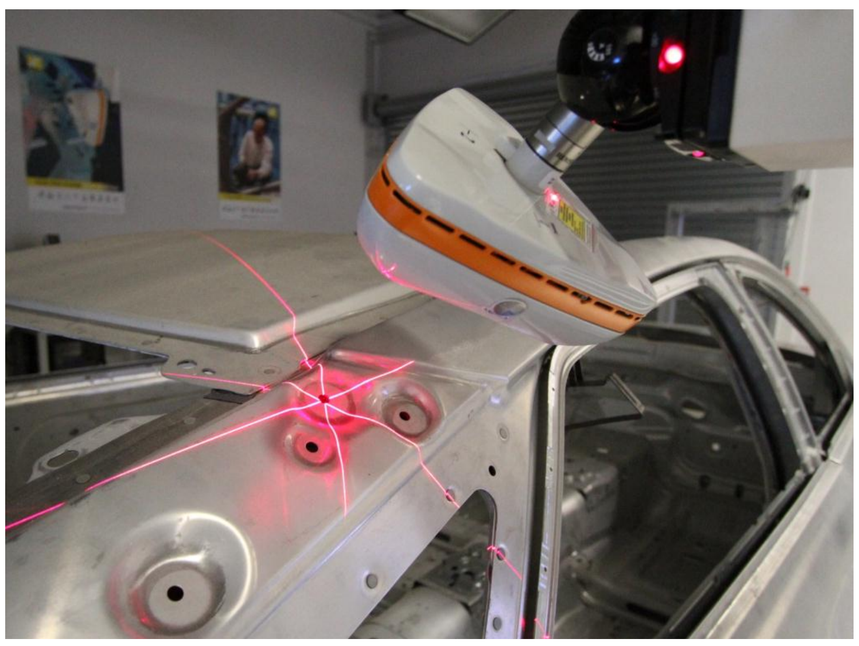


The WMG Product Evaluation Technologies Group, in collaboration with Nikon Metrology and Jaguar Land Rover, are investigating the optimisation of laser scanning technologies for production measurement systems in automotive applications.

Benefits of laser scanning over touch probe measurement include:

- *Accelerated measurement of surfaces and features*
- *Ability to collect significantly more data in a given time period*

Current limitations of laser scanning as a measurement technology include:

- *Less repeatable results than equivalent measurements with touch probes*
- *More susceptible to changes in operating environment*

This poster documents an independent validation study by WMG, of the latest Nikon Metrology laser triangulation sensor (Cross Scanner) and associated CMM programming software, for the measurement of a highly accurate, machined representation of a automotive body shell.

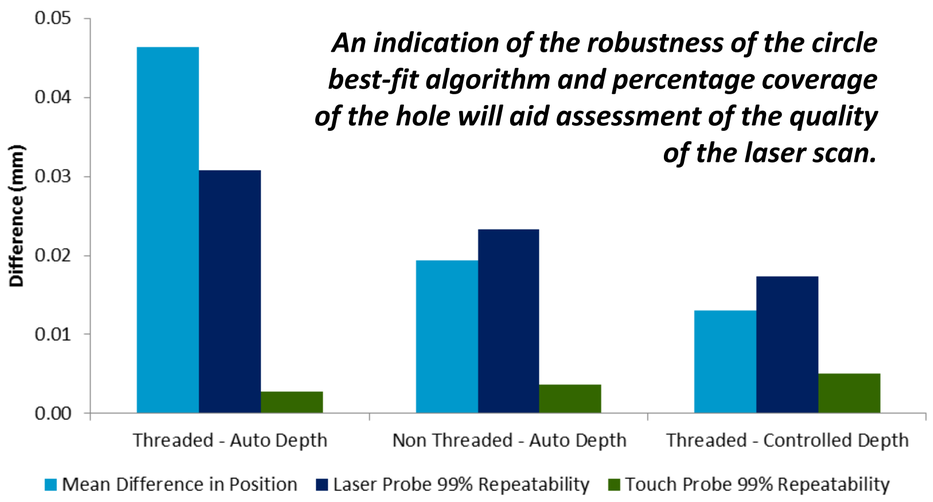
Research objectives:

- *To assess the latest on-CMM laser scanning technology on an artefact representative of an automotive body shell, using a recognised measurement plan*
- *To develop and optimise a measurement strategy that will deliver the best possible quality of data, and could be realistically replicated in a production environment*

Experiment design:

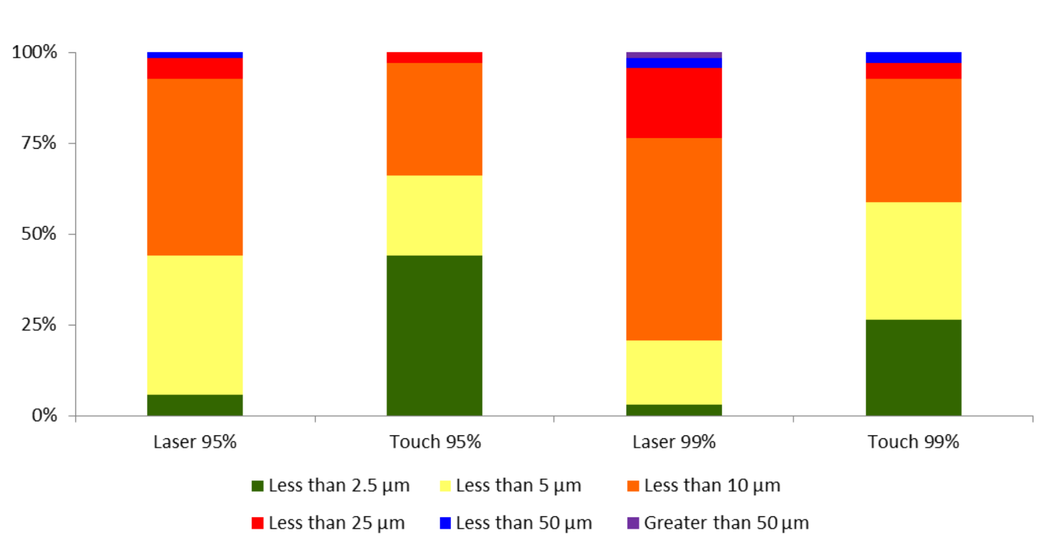
- *A Jaguar Land Rover Environmental Cube (E-Cube) was used as the measurement artefact (assembled to within 0.2mm of nominal)*
- *A Level 3 measurement plan for the corresponding vehicle body-in-white less doors was measured against*
- *30 measurement runs were made for both touch probe and laser scanner measurements, from which repeatability was assessed*
- *All measurements were taken under consistent and identical lighting and temperature (20°C ±1°C) conditions*

Circle measurement:



An indication of the robustness of the circle best-fit algorithm and percentage coverage of the hole will aid assessment of the quality of the laser scan.

Surface point measurement:



95% and 99% repeatability distribution for the laser scanning and touch probes.

There is strong agreement between the reported deviation values - 98.5% of the measured deviations were within 50µm when measured with the laser scanning probe and touch probe.

Conclusions:

- Surface and edge point features have shown that it is possible to obtain a 99% repeatability of 20µm or better
- This potential has been demonstrated in circle features but further work is required to optimise measurement setting
- The agreement between the measured deviation reported by the laser scanner and the touch probe is consistently within 50µm for surface point and circle features. This represents 1.67% of the Body in White tolerance

Impact of research:

The ability to take accurate and repeatable measurements of a product as quickly as possible, is critical to any high volume, high value manufacturing process. This research has been able to demonstrate that time savings of up to 70% of the overall measurement cycle time for body shell inspection are possible, although some of these savings must be sacrificed to improve repeatability. Furthermore, installing the described laser scanning system on to an existing twin column CMM will cost less than a fifth that of installing an additional CMM and results in no increase in the physical “footprint” of quality inspection facilities.

References:

E. Kiraci, A. Attridge, M. A. Williams (2012) 'The use of laser scanning technology to improve the design process', Applied Mechanics And Materials, 110-116 (978-3-03785-262-0)

S. Martínez, E. Cuesta, J. Barreiro, B. Álvarez, (2010) ‘Methodology for comparison of laser digitizing versus contact systems in dimensional control’, Optics and Lasers in Engineering, 48 (12), pp.1238-1246

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