Fabrikazio Aeronautiko Aurreratuko Zentroa
Centro de Fabricación Avanzada Aeronáutica

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Universidad del País Vasco
Euskal Herriko Unibertsitatea

NOVEL APPROACH FOR EFFICIENT LASER LINE SCANNER PATH PLANNING

G. González[1]; N. Ortega[2]; S. Plaza[2]

[1] *Aeronautics Advanced Manufacturing Center (CFAA), Parque tecnológico de Bizkaia, 202, 48170 Zamudio, Spain*
[2] *Department of Mechanical Engineering, Bilbao School of Engineering, Plaza Ingeniero Torres Quevedo 1, 48013 Bilbao, Spain*

Background

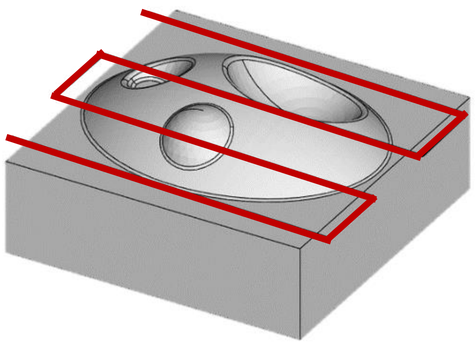
• Laser triangulation scanners are essential for creating detailed digital models of workpieces by capturing high-density point clouds. However, finding the optimal scanning path that balances time and accuracy is challenging. Although other factors, such as the optical properties of the surface, affect the quality of the acquired points, the focal distance and the angles between the light source and receptor relative to the normal vector of the measured point are crucial for determining overall point cloud quality.

Objective

• Develop a simulation program to model the points captured by a laser scanner following a predefined path, identifying high-risk zones such as shadowed regions or glare.

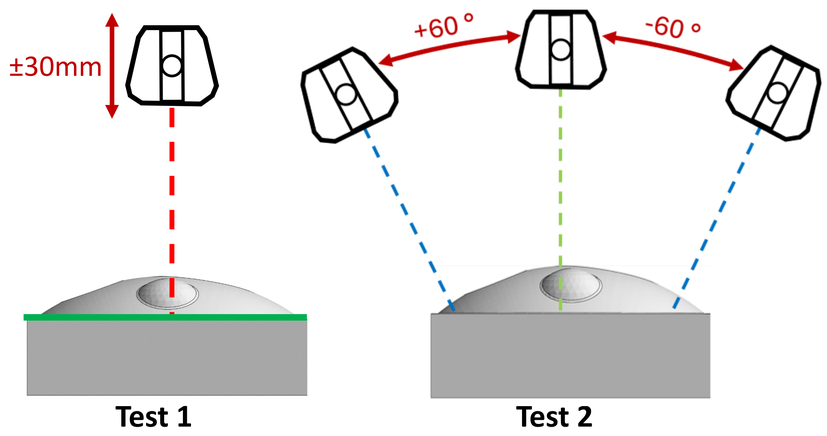
• This software will help improve measurement strategies to reduce high-risk zones, imbruing measurements stability and accuracy.

Methodology

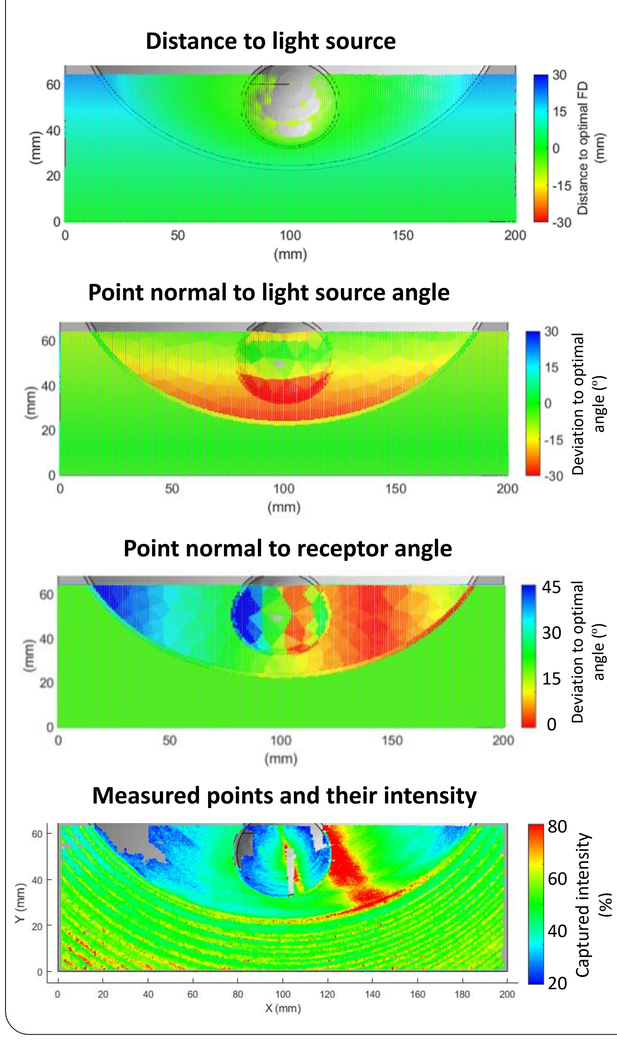


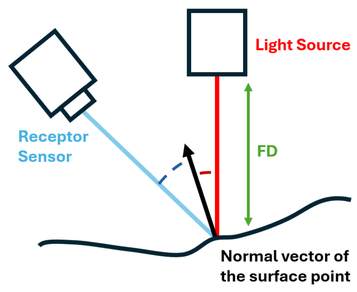
A quick-to-implement path was defined, and two test trials were conducted with slight adjustments to this path.
A modified NPL-WP-150-000 freeform reference standard workpiece (AISI 304L) and a Surface Measure 606T line laser scanner were used.

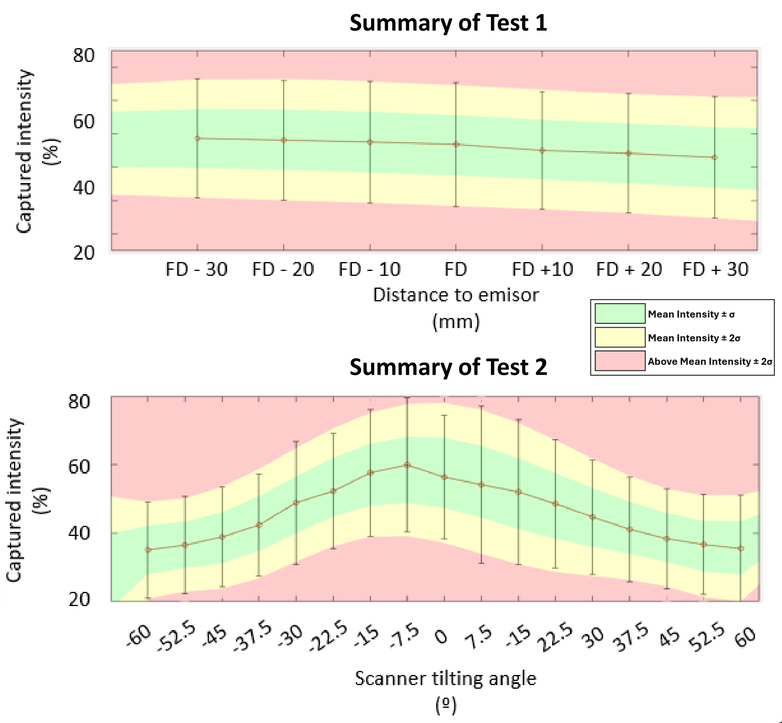
• **Test 1**: Scanner perpendicular to the lower plane, varying the focusing distance (FD).
• **Test 2**: Constant focal distance, varying the tilting angle of the scanner.



Example: Test 1 with lower plane at optimal Focusing distance (FD).







Conclusions

1.- The simulation program effectively identifies high-risk zones, allowing the selection of an optimal strategy that prevents both shadowed regions and glare.

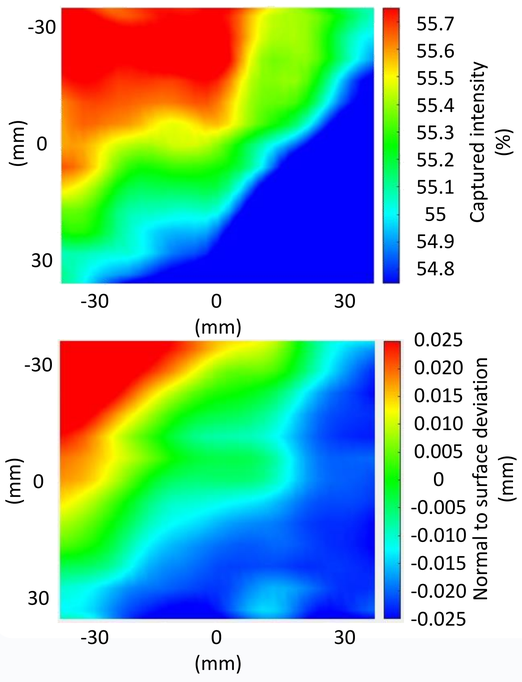
2.- Lower variability and smaller normal-to-surface deviation have been detected for intensities near 50% of the scanner receptors' capacity.

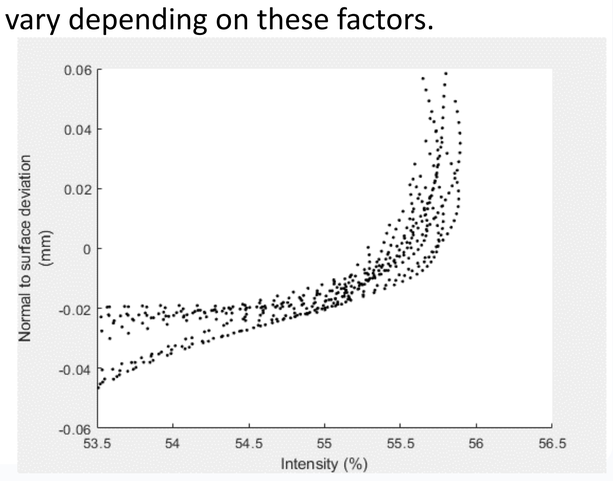
3.- The simulation program is not yet capable of simulating machining marks because it operates on a CAD file.

Future work

Develop an efficient method to correlate the captured intensity with the expected point deviation on the surface normal.

This analysis should be conducted for each material and surface finish, as results will vary depending on these factors.





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Contact:
guillermo.gonzalezm@ehu.eus