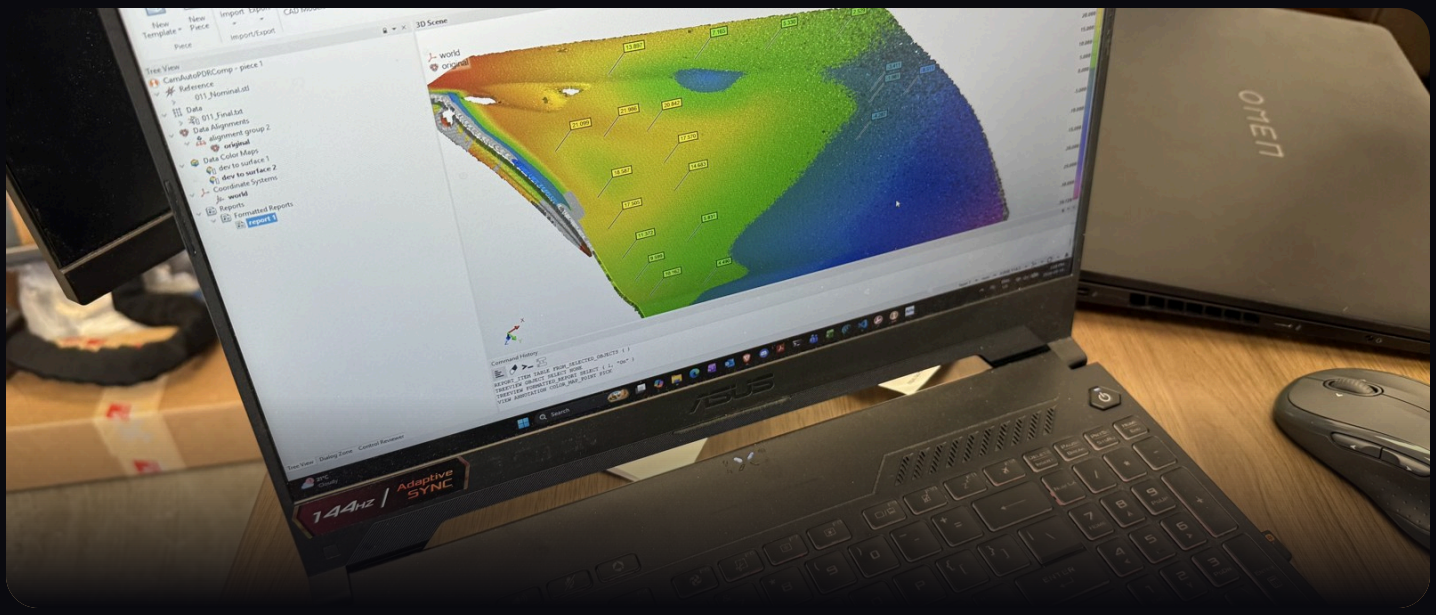


APPLICATION NOTE

Objective Surface-Deviation Inspection

How a surface can be judged against the geometry it is supposed to hold, instead of against an opinion. A golden-model comparison captured with DepthScan, computed in PolyWorks, shown as a per-point deviation map.

+/-0.5mm	~2.6M	0.01mm	11
Tolerance band evaluated	Points per panel scan	Mean deviation resolved	Panels judged objectively

Some surface judgments have always been made by eye. An inspector looks across a panel under raking light and forms an opinion about how close it is to where it should be. That opinion is slow, hard to defend, and changes from one inspector to the next. This note walks through replacing that opinion with a measurement, using a real surface-quality contest as the representative scenario.

THE PRINCIPLE

Golden-model surface comparison

A surface can be judged against the geometry it is supposed to be, rather than against a human impression. The method has four steps and produces a number, not a verdict.

1
Capture reference
Scan the part while it is at its target geometry. This full-color 3D scan is the golden model.

→

2
Process the part
The part is worked, formed, repaired, or runs through production.

→

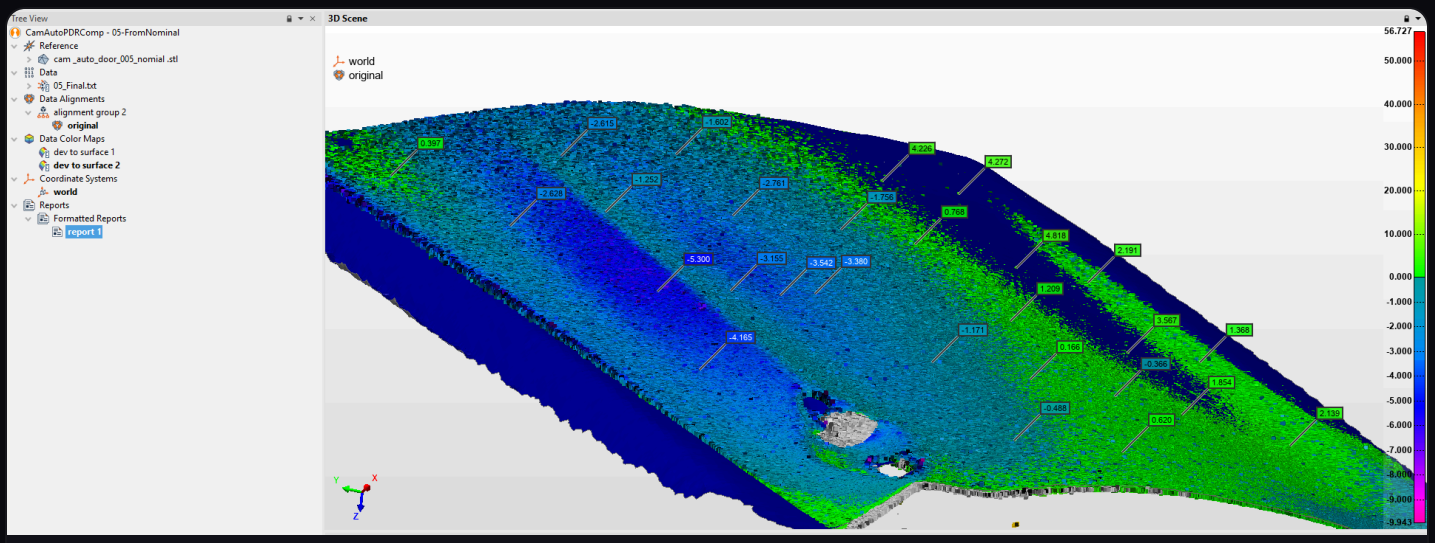
3
Rescan
Capture the part again, after the process, from a repeatable pose.

→

4
Compute deviation
Measure the distance from every point back to the reference and color-map it.

The result is objective because the reference is the part's own target geometry, and repeatable because the same computation runs every time. The areas still standing away from where they should be light up on the map. The areas that returned to true go quiet.

> *The reference is not a person's memory of a good part. It is the good part, captured in full 3D.*



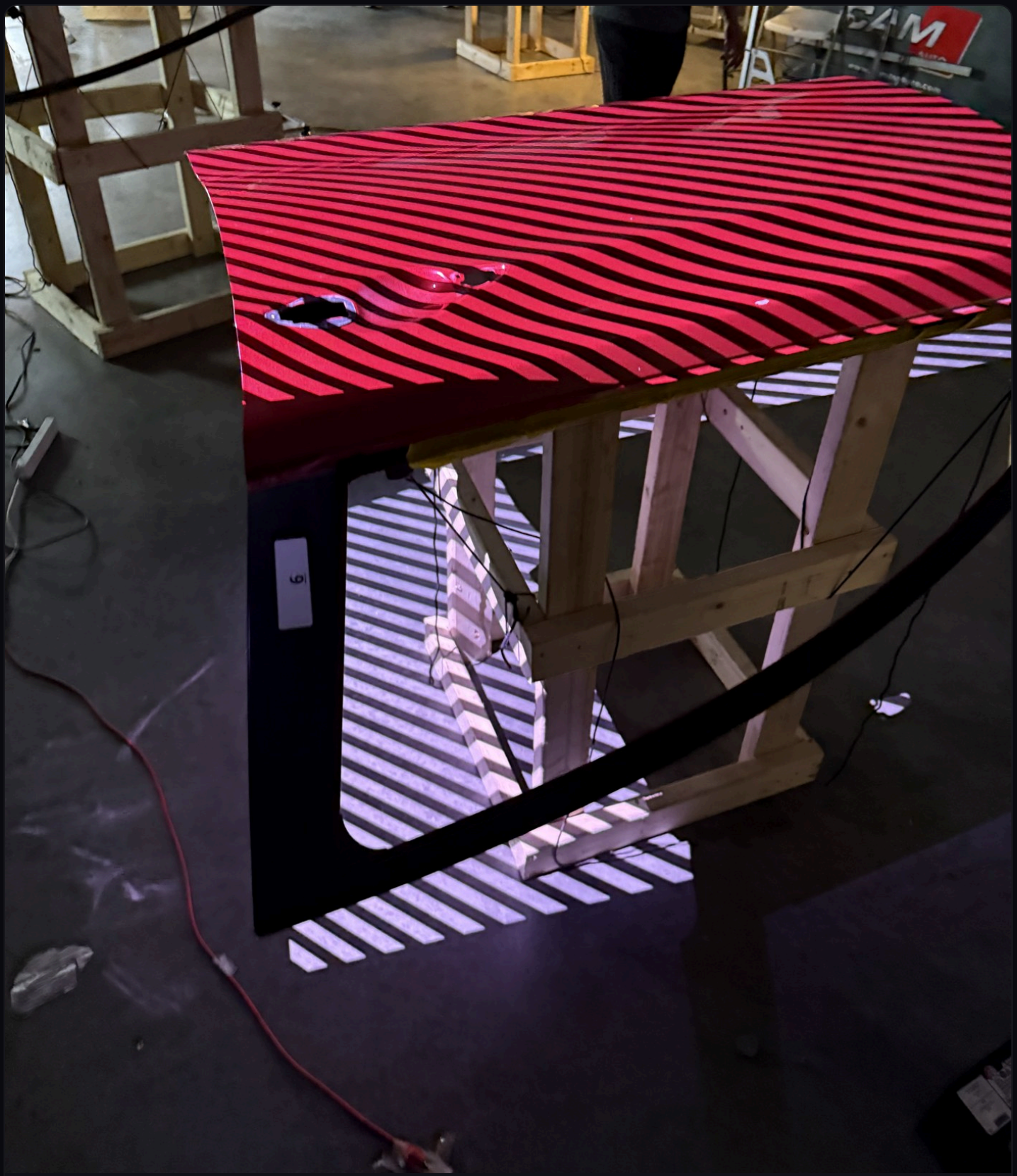
Per-point deviation from the golden-model reference, color-mapped across the full surface in PolyWorks. Evaluated against a +/-0.5 mm tolerance band.

A localized rise at one point reads differently from broad warping across the whole panel. The color map makes that difference legible at a glance, even to someone who does not work in inspection software, which matters when the result has to be handed to and trusted by a non-specialist.

THE PROCESS

Capture that holds up as evidence

For the result to be defensible, every part has to be measured the same way. An Auto Focus DepthScan mounted on a robot arm presents the sensor to each part from the same repeatable pose, so no part is measured under different conditions. Each capture produces a full-color 3D scan of roughly 2.6 million points.



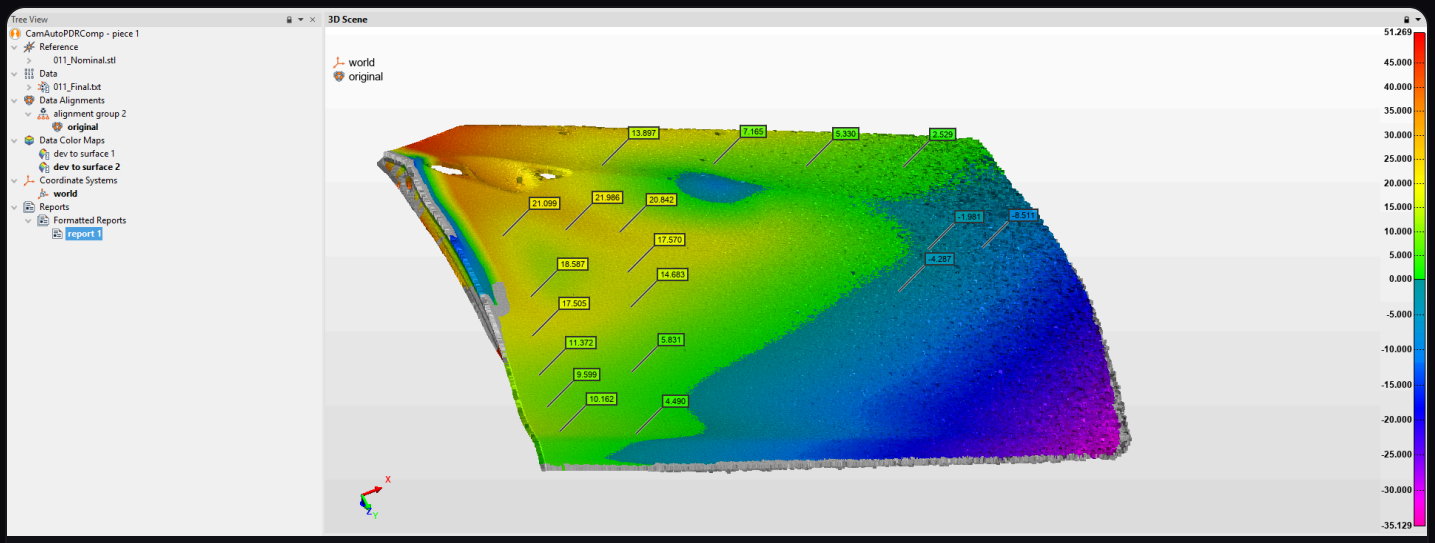
DepthScan capture in progress. The projected structured-light pattern encodes the full surface, including the fine detail and color that make

THE PROOF

A real contest, judged by geometry

The representative scenario was a paintless dent removal competition hosted by Integral Equipment. Contestants pulled dents out of damaged door panels, and the winner had to be the repair closest to the original factory surface. Eyeballing it under a light would not survive a dispute, so the panels were judged by geometry instead.

Each panel was scanned undamaged to build its golden-model reference, then rescanned after the repair. Across the field of 11 panels, mean deviation from factory geometry sat in the range of hundredths of a millimeter, and the deviation map showed exactly where each panel still lifted away from true. No human eye, no subjective call, the same number every time.



A second panel's residual deviation field. The signature, where the error concentrates, is as informative as the magnitude.

Why it matters beyond a contest

This was a dent competition, but the capability is dimensional surface inspection. The same golden-model comparison checks **stamped panels, welded assemblies, and formed sheet metal** against the geometry they are supposed to hold, objectively and repeatably, on a real surface rather than a sample of points. Anywhere a surface judgment is made by eye today and has to stand up to scrutiny, it can be made with a number instead.

DepthScan accuracy is validated to VDI/VDE 2634. Performance claims trace to that validation, not to estimates.

Have a surface that gets judged by eye today?

Talk to us about objective surface-deviation inspection for your parts. ajile.ca