



High-Definition Metrology and Vision Application Note #09-08

Diagnosis of an Engine Machining Process Problem - a *ShaPix* Case Study

The Powertrain Challenge



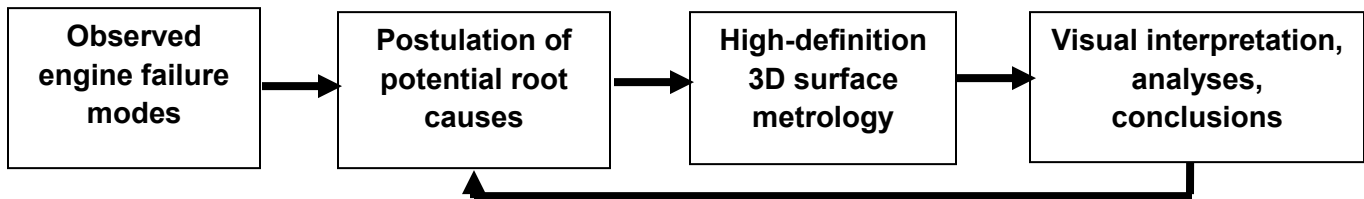
A Coherix customer, an original Equipment Manufacturer (OEM), bought diesel engines from a Tier 1 supplier. The OEM was accumulating as much as \$1 Million in warranty costs per month for engine failures in the field due to combustion fuel leakage. The OEM urgently needed data to prove to the supplier that the failures were caused by the engine manufacturing process as opposed to customer induced “wear and tear”. The only means for being able to provide that evidence would be to perform comprehensive measurement of the engine surface flatness.

The Metrology Need

A comprehensive measurement of an engine block deck face’s flatness was required to demonstrate the departures from the surface characteristics required for reliable engine performance. The process of tracing down the root cause of failure inherently would require multiple measurement and analysis cycles

The Measurement Requirements

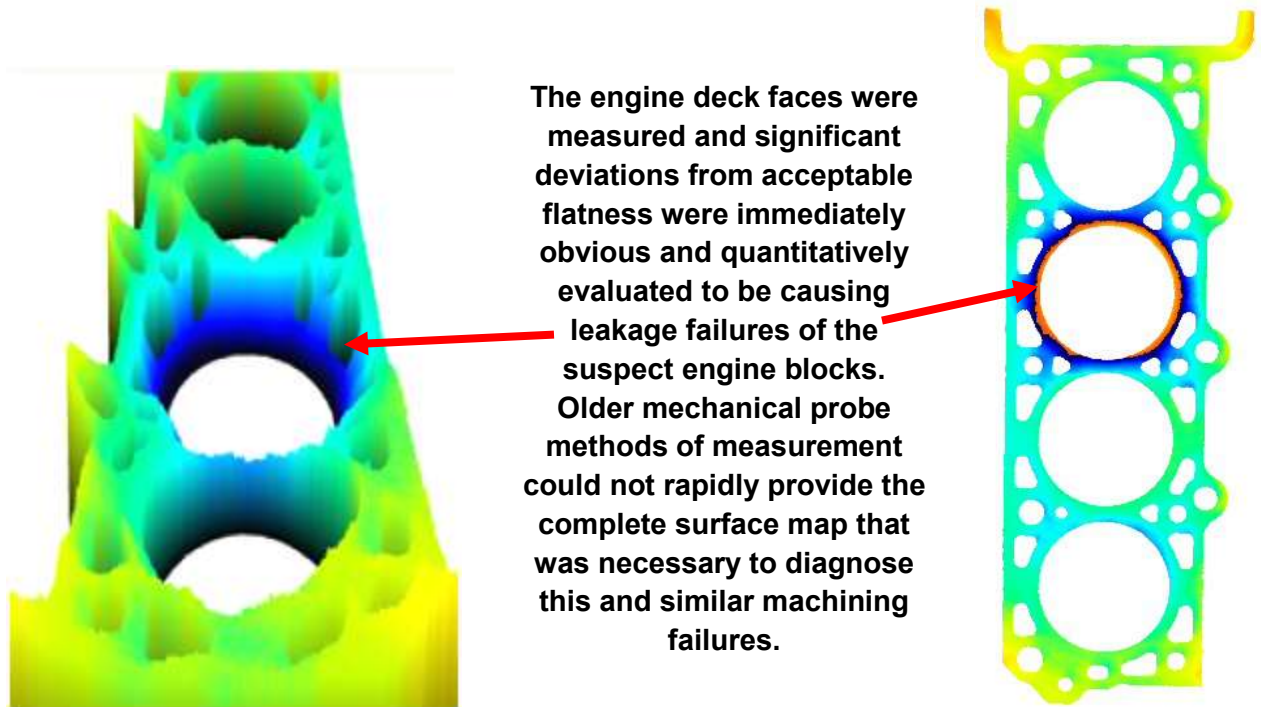
It was necessary to measure the flatness of the entire engine deck face to an accuracy of approximately 1 micron in order to diagnose the issues leading to engine failure. Both measurement of global surface characteristics and high-definition measurement of local surface flatness in critical surface areas were required.



The ability to see and immediately understand, in visually obvious detail, the surface characteristics of the engine deck faces for failed and newly machined engines would be a vital weapon in being able to rapidly home in on the root causes of the engine failures. In addition the ability to define and implement new surface measurements within minutes would significantly reduce the elapsed time for reaching a final conclusion regarding the actual root causes of the failures.

The Coherix Solution

The **ShaPix** comprehensive output data and short measurement time allowed the OEM to rapidly identify the root-cause of the engine failures. The **ShaPix** operator interface allowed the user to quickly isolate regions of interest to facilitate root cause analysis for the engine failures in the field. The visual data allowed the user to understand the interactions between the part and the applicable machines (cutter profile, rotation speed, feed rate, feed direction, fixture integrity and rigidity, and coolant, etc). This relatively short measurement time allowed the process and tooling engineers to efficiently conduct a series of experiments to improve the manufacturing process. The **ShaPix** user-configurable zone flatness feature allowed the user to quickly identify the localized regions where leakages were likely to occur.



The **ShaPix** Results

From the **ShaPix** measurement data, it was possible to rapidly determine that the root cause of failures was the use of excessively worn tools in one stage of the machining process.

The Powertrain Value Delivered

The ShaPix measurement system served as a fast, detailed, and highly accurate investigative tool that solved a financially serious production quality problem for the OEM and its supplier. The speed and accuracy of the solution delivered:

- Savings of about 1 Million dollars per month of warranty costs.
- Rapid identification of the root cause for the part failure, expediting problem resolution.
- Specific guidance for the appropriate corrective actions in the manufacturing process.
- Improved part quality once the root cause was addressed.

The feasibility of preventing of future expensive production “spills” or warranty costs was proven by the rapid and accurate detection of this failure mode using **ShaPix** high-definition measurements