# Automated Large Area Profilometry
# of Printed Circuit Boards



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## INTRODUCTION:

Scaling up of manufacturing processes is necessary for industries to grow and keep up with constantly increasing demands. As manufacturing process scales up, the tools used in quality control also need to be scaled up. These tools must be fast to keep up with the production rate, while still maintaining high accuracy to meet product tolerance limits. Here, the Nanovea HS2000 Line Sensor showcases its value as a quality control instrument with its fast, automated, and high-resolution profilometry capabilities.

**IMPORTANCE OF 3D NON-CONTACT PROFILOMETRY FOR QUALITY CONTROL**
The technology behind the topography is non-contact axial chromatism. This technology is a non-destructive technique that is able to measure the surface of all types of samples. Axial chromatism associates wavelength with a specific height, making reflectivity, transparency, and curvature have no influence on accuracy. With the Nanovea HS2000 Line Sensor, multiple samples can be repeatedly scanned by configuring a simple macro. The use of a macro allows users to easily use the instrument, minimizing constant instrument handling and human error. With scanning speeds up to 1m/s and 192 points per pass, the Nanovea HS2000 is able to quickly obtain surface data on a large number of samples.

**MEASUREMENT OBJECTIVE**

In this study, the Nanovea HS2000 Line Sensor showcases its fast, automated abilities by scanning six different printed circuit boards (PCB). Each PCB had differing heights and dimensions, but the full surface of each board was captured by setting an 18-scan macro.

## DISCUSSION:

In the results below, the false color view and 3D view for each PCB is presented below. Additional analysis examples were also included for some results to showcase the capabilities of our analysis software.

In the scan conducted, the maximum height range of our pen was limited to 4mm. Large height features had to be captured by scanning the same PCB multiple times at varying heights and patching the data together. The total time for the macro to complete was approximately 40 minutes, averaging slightly over 2 minutes per scan. If the samples were flat, it would only take 12 minutes to scan the same area since patching would not be needed.

## RESULTS: PCB 1

| Plane parameters | Unit | Plane 1 | Plane 2 | Plane 3 | Plane 4 | Plane 5 |
|---|---|---|---|---|---|---|
| Zmin | mm | 0.2989 | 5.534 | 6.610 | 11.53 | 13.99 |
| ZMean | mm | 2.126 | 6.326 | 6.976 | 12.50 | 15.16 |
| Zmax | mm | 2.921 | 6.764 | 7.225 | 13.07 | 15.37 |

**Step Height Analysis**

## RESULTS: PCB 2

**False Color View**

3D View

## RESULTS: PCB 3



False Color View

**3D View**

**Dimensional Tolerance Limits**
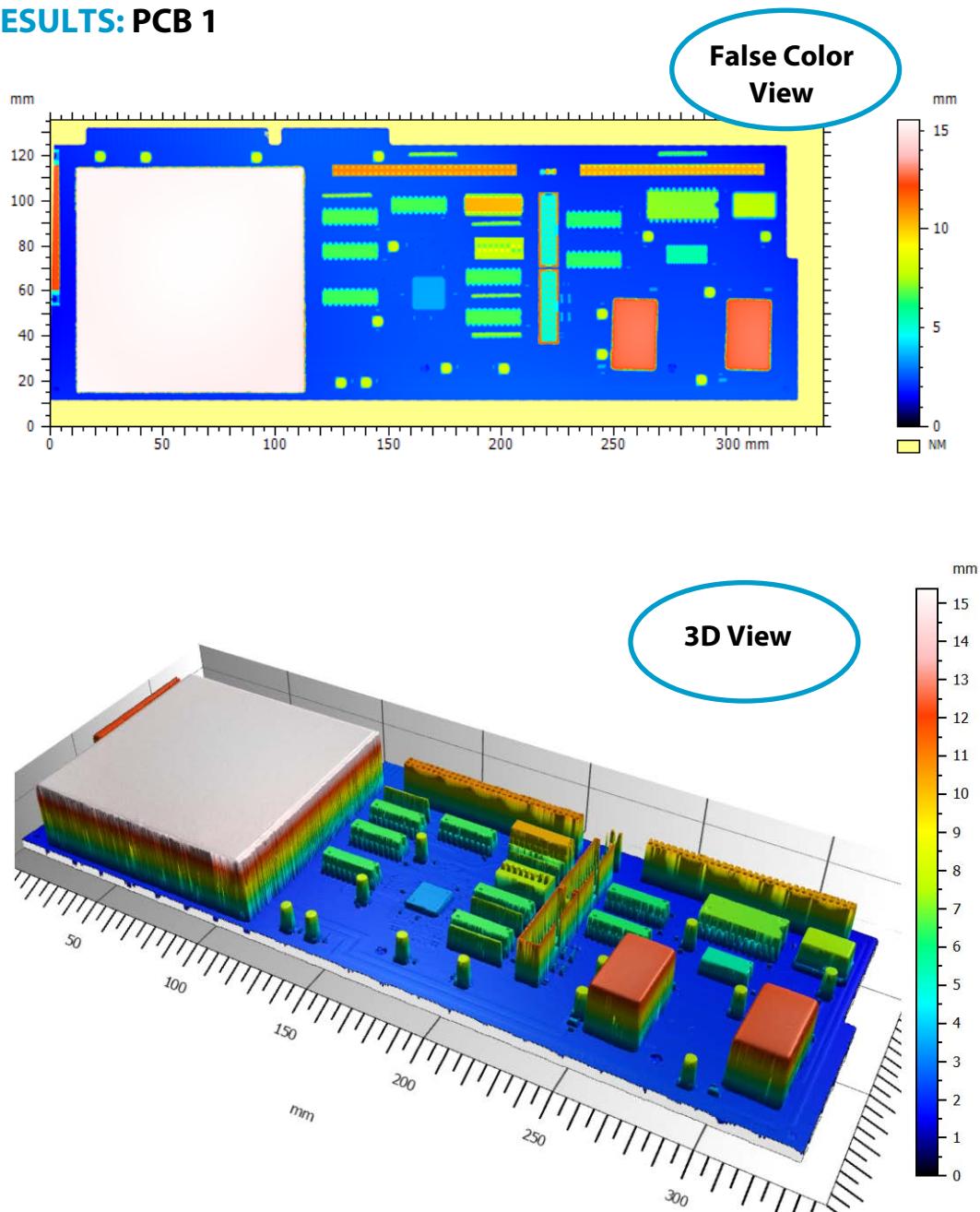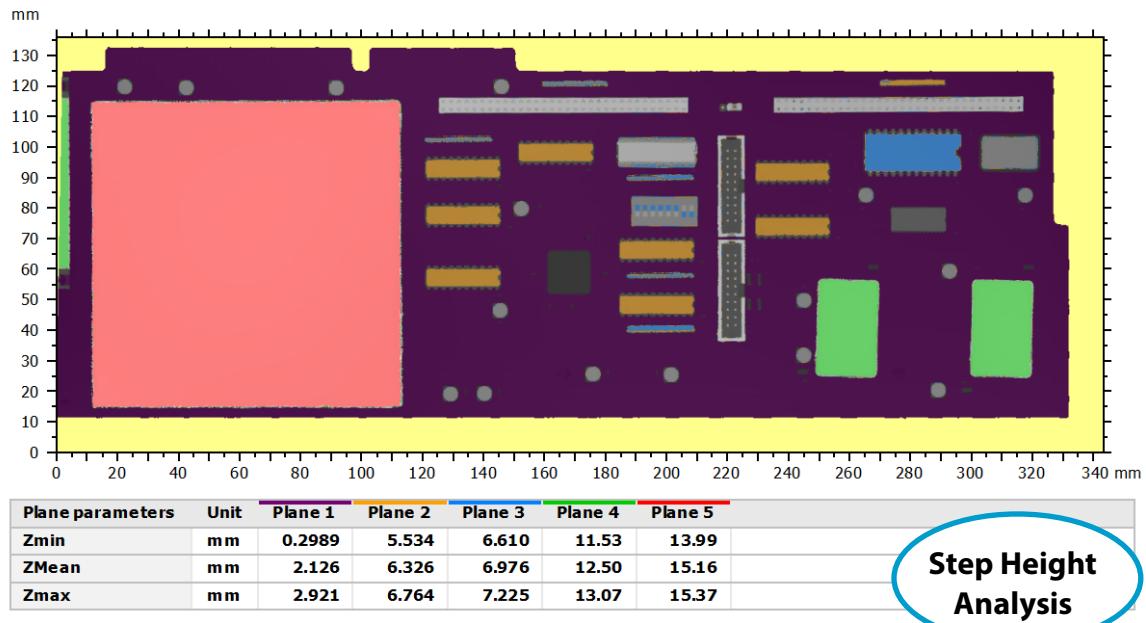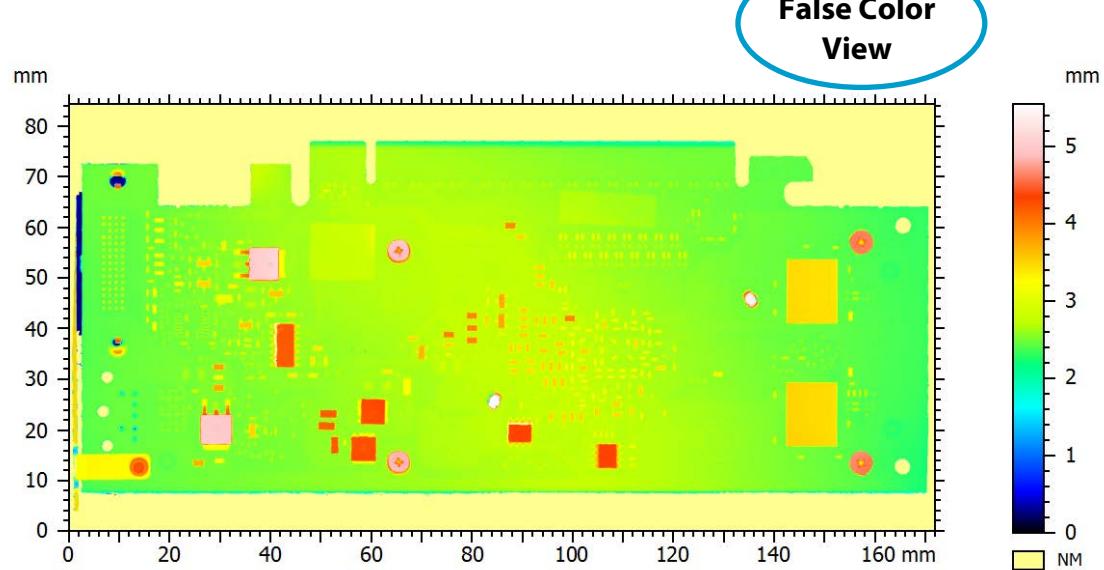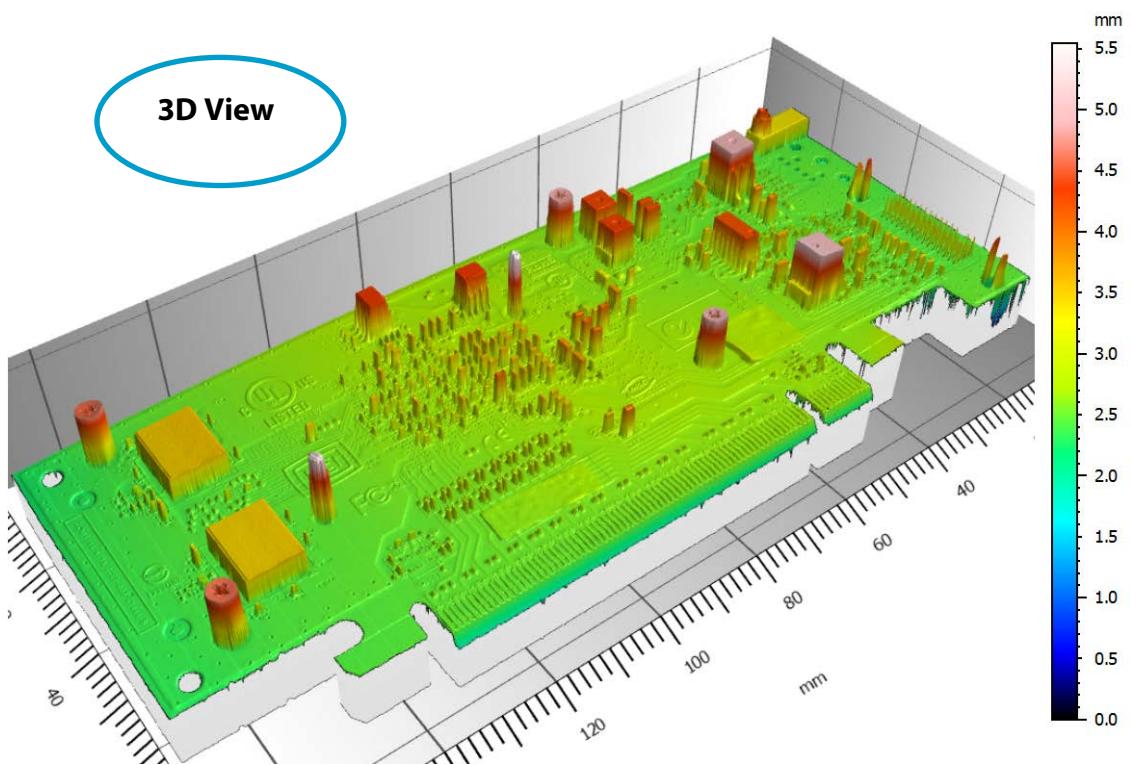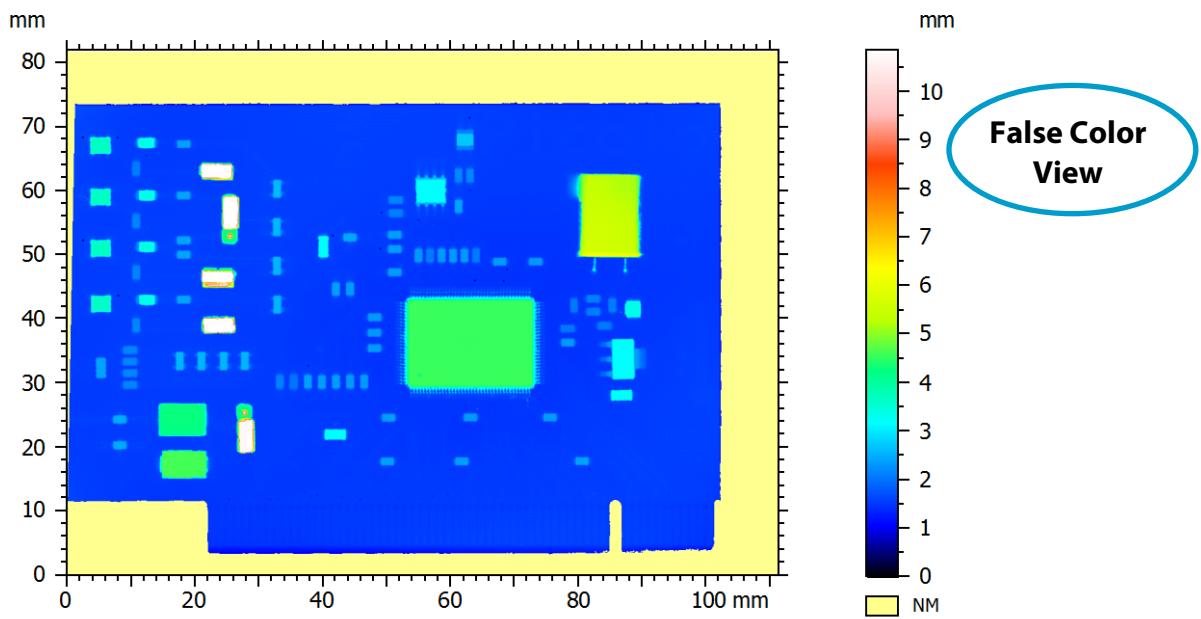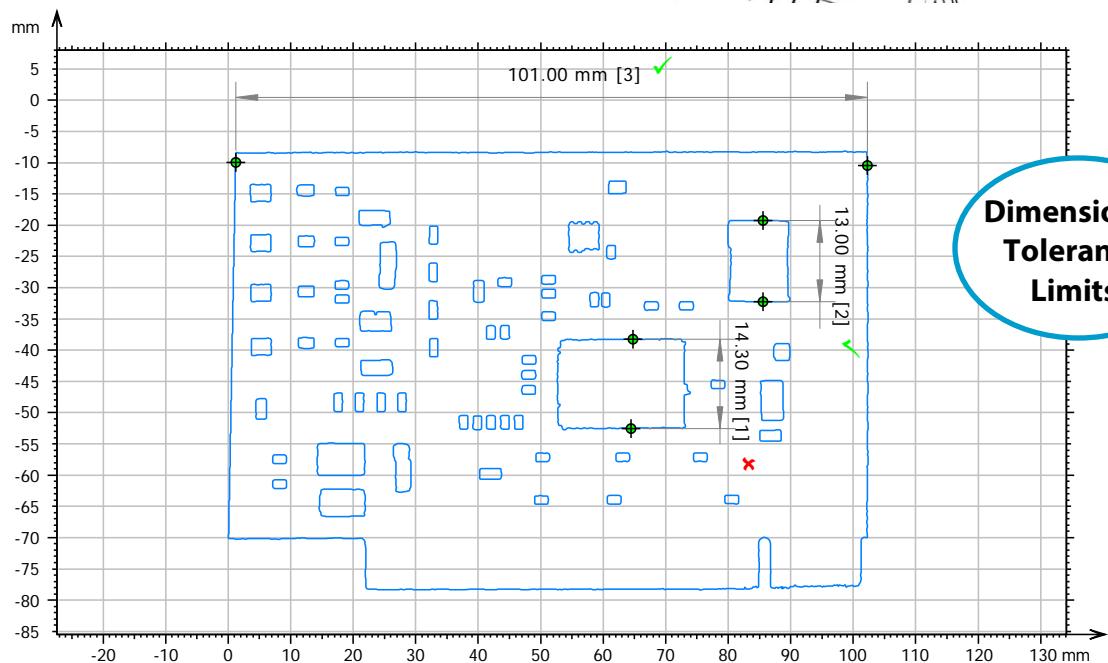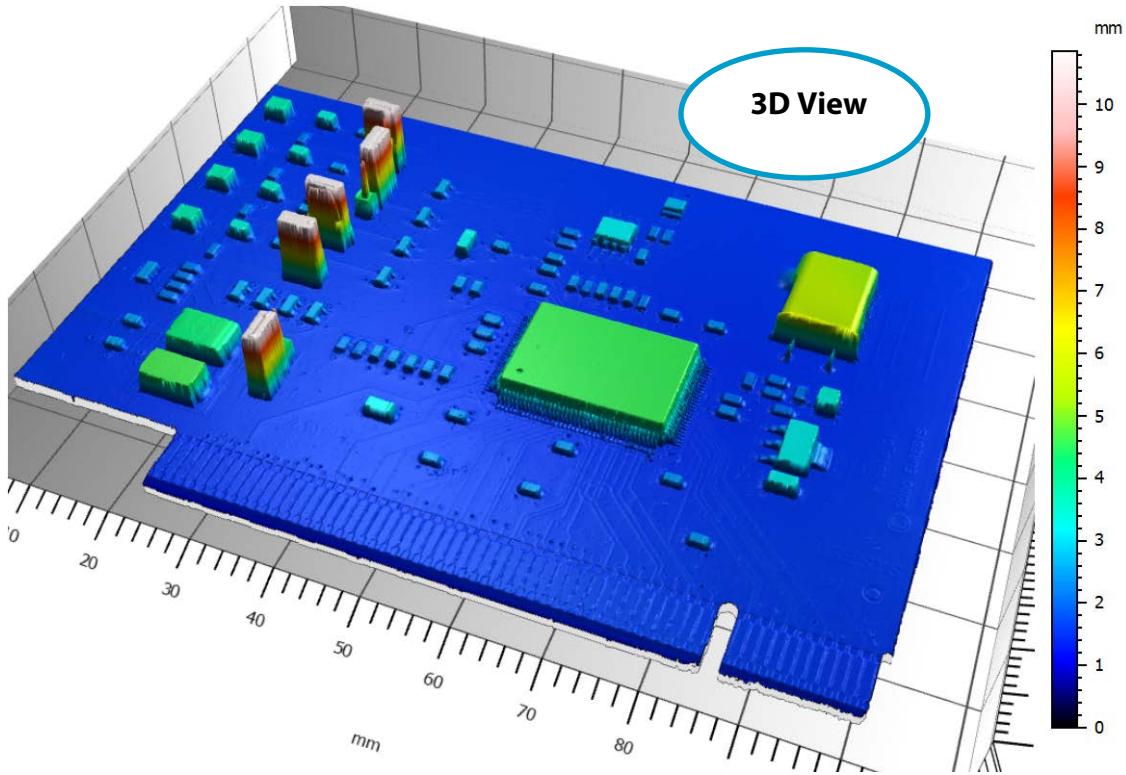
**False Color View**

| Parameters | Value | Unit | Tolerance | |
|---|---|---|---|---|
| Distance - Dimension 1 | 14.30 | mm | 13.00 mm ± 1.00 mm | ✗ |
| Distance - Dimension 2 | 13.00 | mm | 13.00 mm ± 1.00 mm | |
| Distance - Dimension 3 | 101.00 | mm | 100.00 mm ± 2.00 mm | |

## RESULTS: PCB 4





3D View

Intensity False Color View



Intensity 3D View

## RESULTS: PCB 5



False Color View



3D View

**Warpage Study with Flatness Parameters**

| ISO 12781 | | |
|---|---|---|
| **Flatness Parameters** | | |
| FLTt | 601.5 | µm |
| FLTp | 336.6 | µm |
| FLTv | 264.9 | µm |
| FLTq | 149.1 | µm |

## RESULTS: PCB 6



**False Color View**

**3D View**
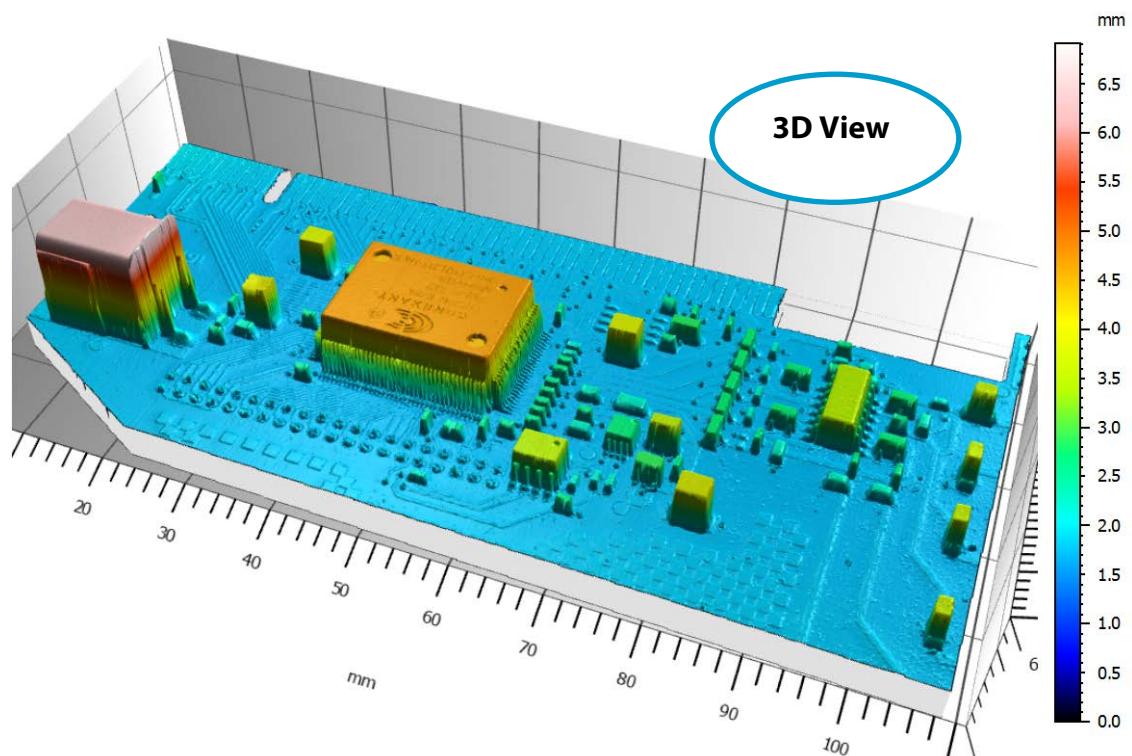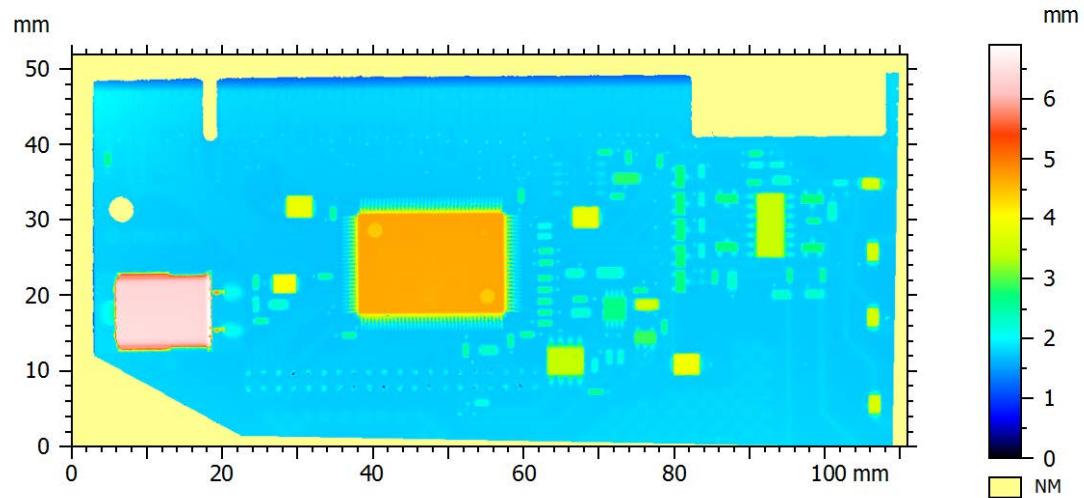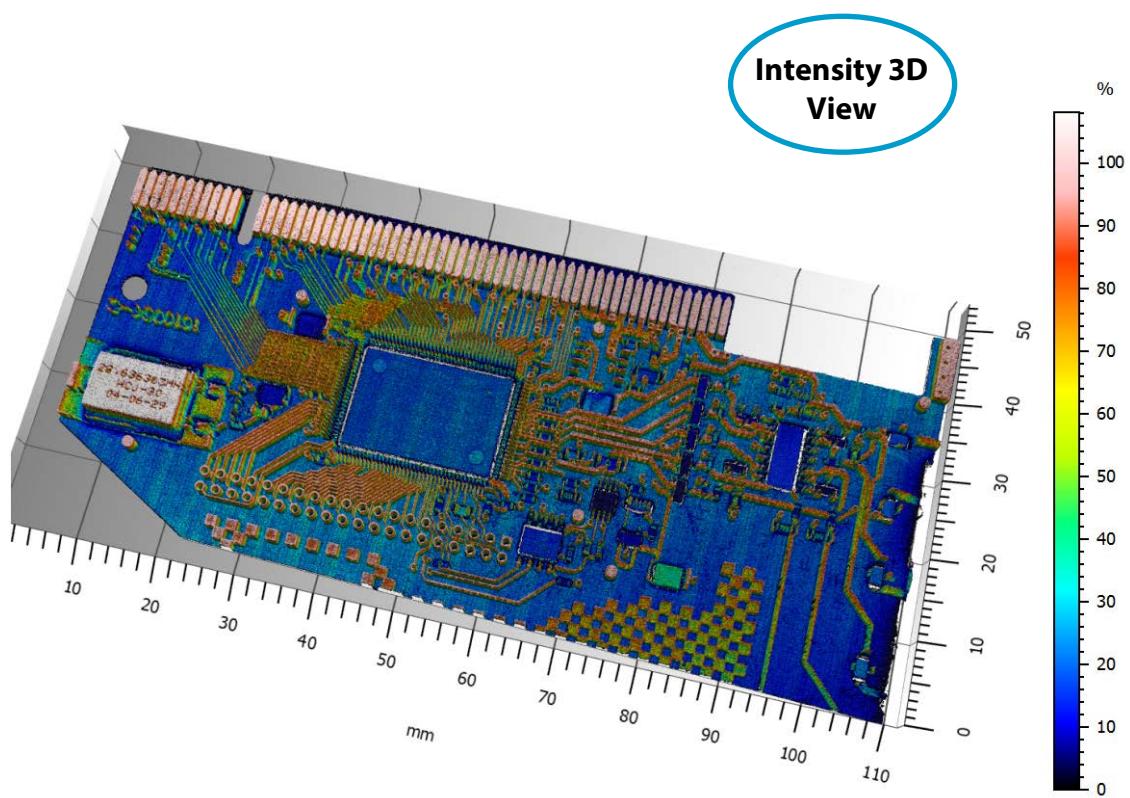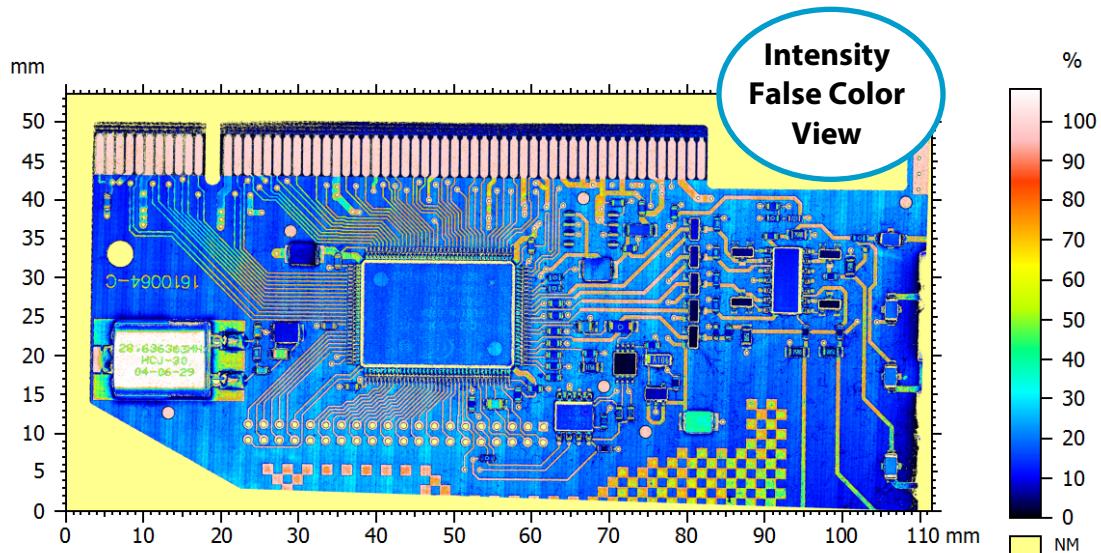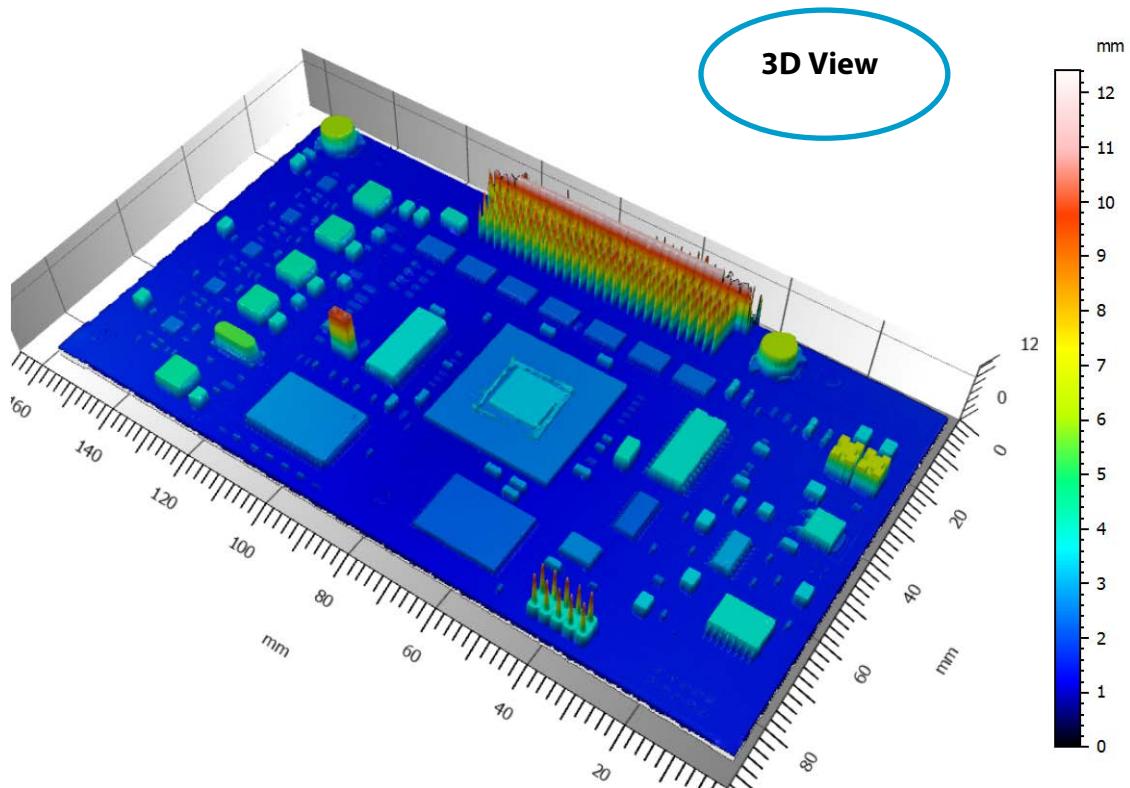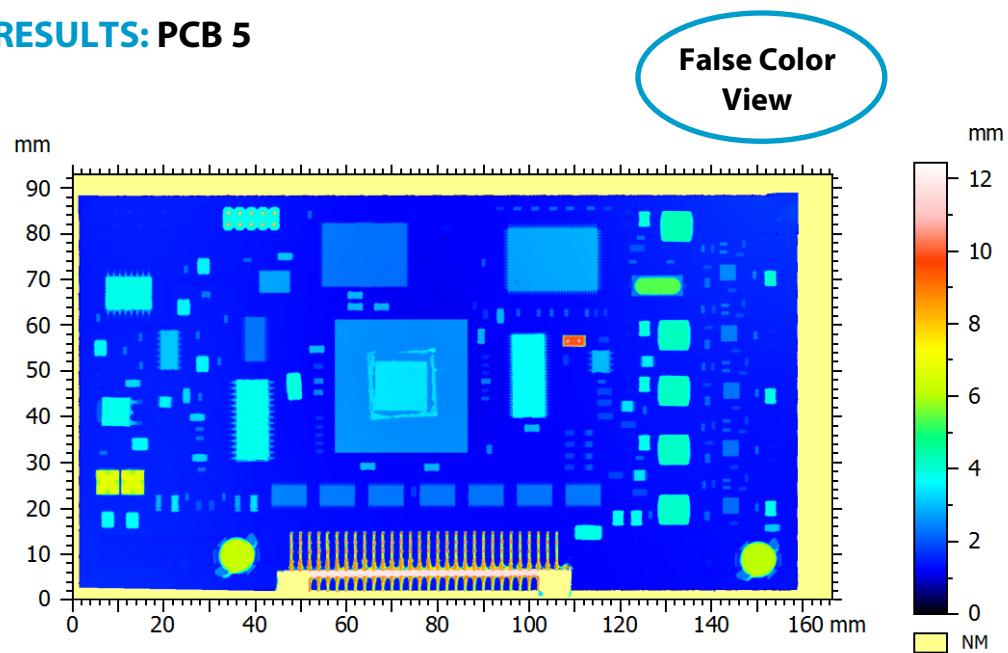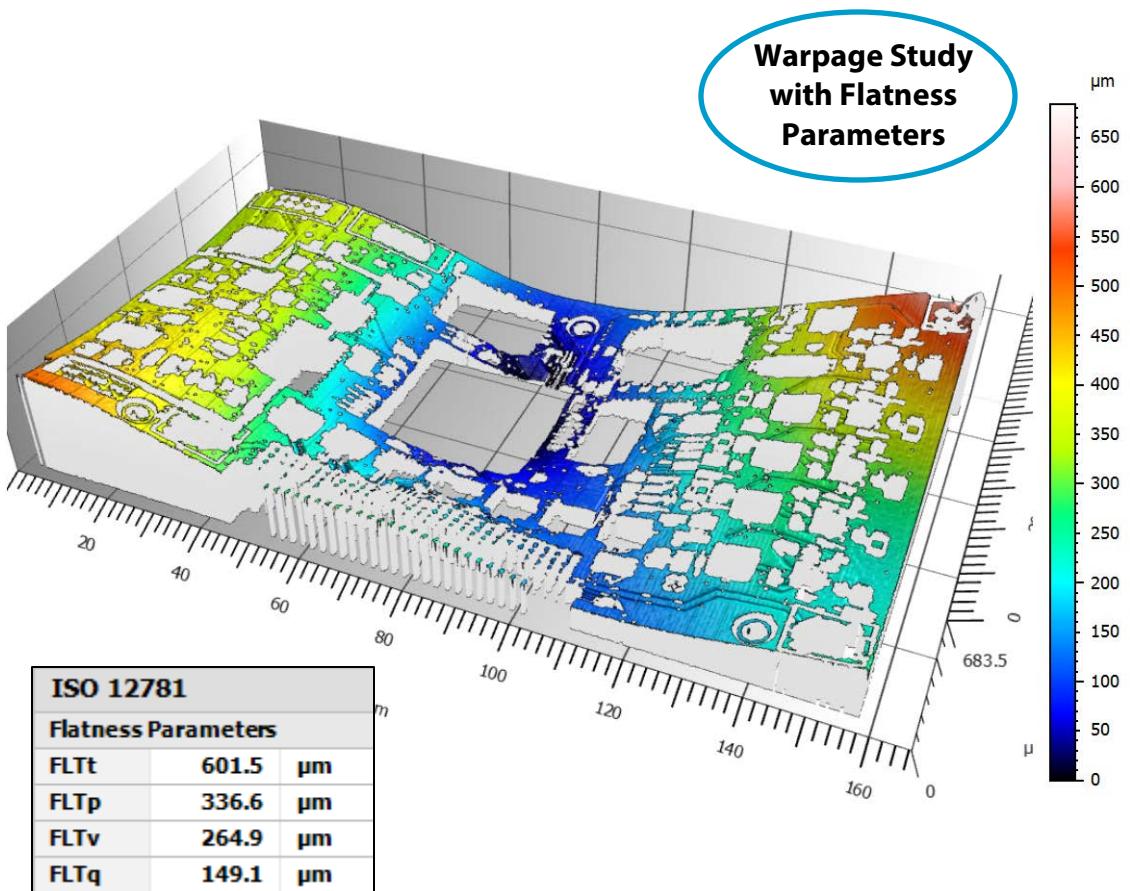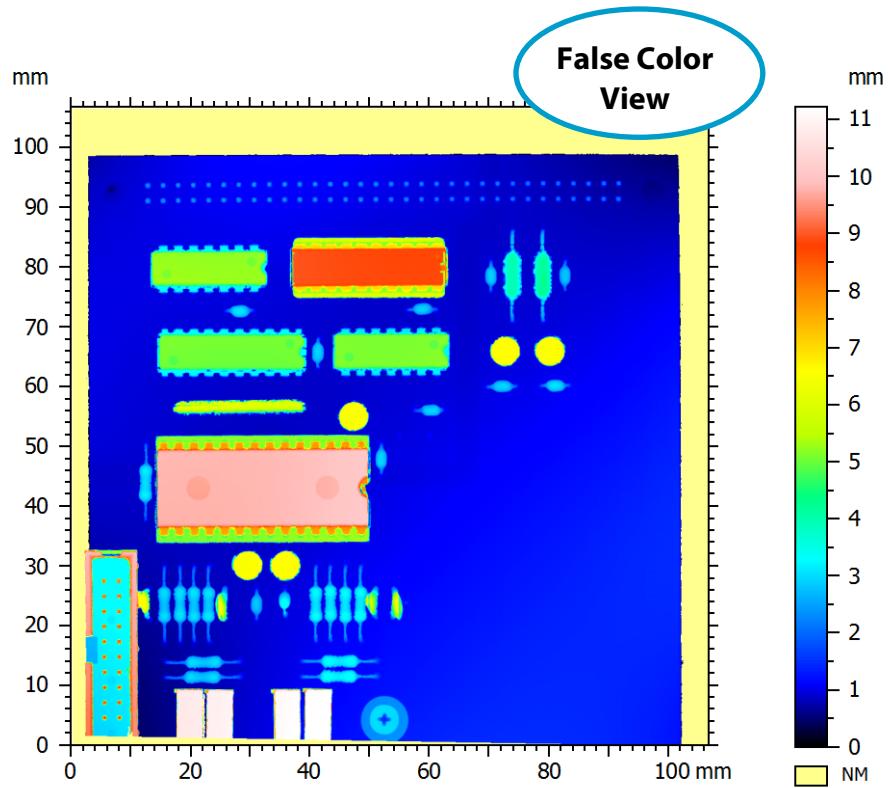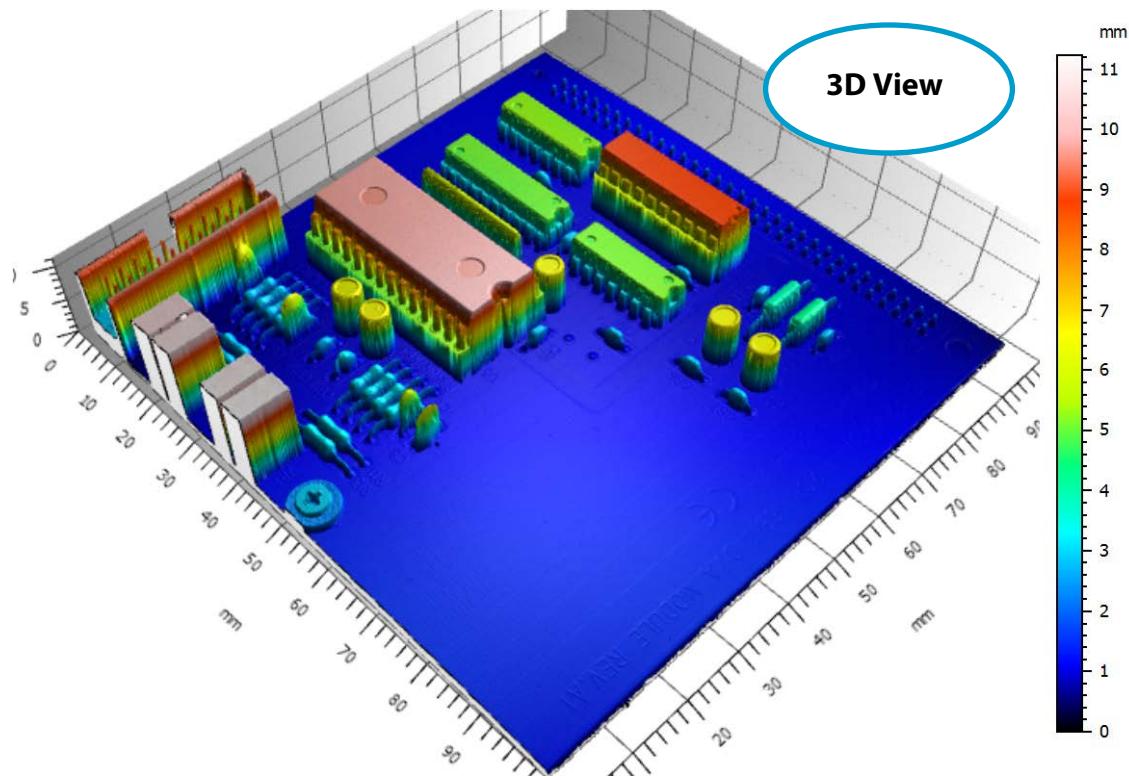
## CONCLUSION:

The Nanovea HS2000 Line Sensor conducted profilometry scans on six different PCBs. Each PCB had unique features that were all captured with a single macro. This macro covered a large area with a high resolution of 25um x 25um step size in 40 minutes, obtaining the full surface of each PCB board. The false color view and 3D view was shown for each PCB board, with the addition of automatic step height analysis, contour analysis with dimensional tolerance limits, intensity views, and warpage study. These are just a few examples of the capabilities of our analysis software.

From this study, the automation of high resolution, large area profilometry scans has shown to be beneficial for quality control applications. It meets the requirement of speed and accuracy that quality control tools need to fulfill. Its automation abilities also minimize user handling, making the instrument easier to use and decreasing time required for setup. With its ability to scan all types of samples, the Nanovea HS2000 Line Sensor can be used in all industrial fields as well.

Learn more about the Nanovea Profilometer or Lab Services