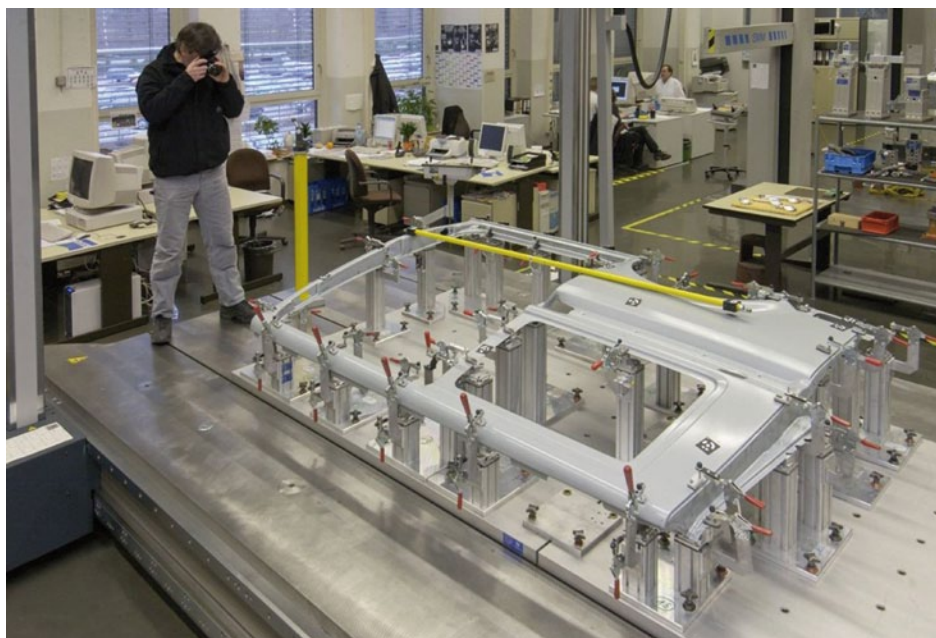# Application Example: Quality Control

Sheet Metal: Measuring Characteristic Features Using the Optical Measuring Machine TRITOP^{CMM}

Measuring Systems: TRITOP^{CMM}
Keywords: Hole pattern, primitive location, Verification, Fixtures

Measuring tasks that so far could only be performed using tactile 3D coordinate measuring machines, measuring arms or measuring aids, can now be carried out easily and efficiently with the TRITOP^{CMM} system as it does not require any complex and maintenance-intensive hardware.

Quality Control / Sheet Metal

Measuring Characteristic Features Using the Optical Measuring Machine TRITOPCMM

Measuring Systems: TRITOPCMM
Keywords: Hole pattern, primitive location, Verification, Fixtures

The portable photogrammetry system TRITOPCMM measures coordinates, primitives and sections of three-dimensional objects fast and precisely. Measuring tasks that so far could only be performed using tactile 3D coordinate measuring machines, measuring arms or measuring aids, can now be carried out easily and efficiently with the TRITOPCMM system as it does not require any complex and maintenance-intensive hardware. With TRITOP, the measuring machine comes to the measuring object (Fig. 1).

As shown in Fig. 1, the system consists of a laptop including the evaluation software, the digital TRITOPCMM camera, coded and uncoded reference points and a scale bar set with accessories. First, interesting areas of the object are marked with the reference points and the marker pens. Special adapters are used to define bores, punched holes and edges. Then, some coded markers together with the scale bars are distributed around the measuring object or placed on the part itself.
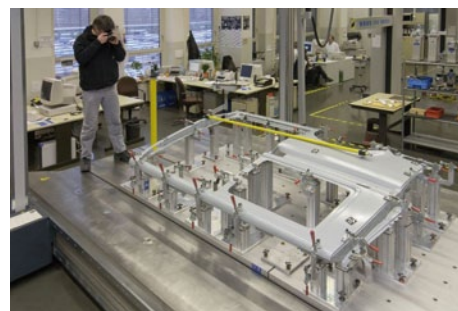

Fig.1: TRITOPCMM with laptop, camera and accessories

Now, high-resolution images are recorded by means of the camera and transferred to the laptop. In the individual images, TRITOPCMM automatically defines the centers of the coded and uncoded reference points. Based on the coded markers, the recorded images are then virtually combined such that the image points correspond to the calculated positions of the markers.

The entire evaluation process is carried out fully automatically within just a few minutes. Then, contrast lines and features may be defined by clicking on the start points. Fig. 2 shows the measuring results of a sheet metal for which the coded and uncoded reference points as well as special characteristics (e.g. holes, edges and painted lines) were measured.

As CAD data can be loaded and displayed in TRITOPCMM, and because the measuring system contains an inspection module, it is possible to carry out a complete quality control with TRITOPCMM. For this purpose, the current measuring data is aligned to and compared with the nominal (CAD) data. TRITOPCMM can easily determine the measuring values, the deviations and the

position of the values in the tolerance spectrum and clearly illustrate the results (Fig. 3). In addition, it is possible to integrate images into the measuring report which then is available in different formats (Excel, Word, HTML) for documentation and further processing of the measuring values.
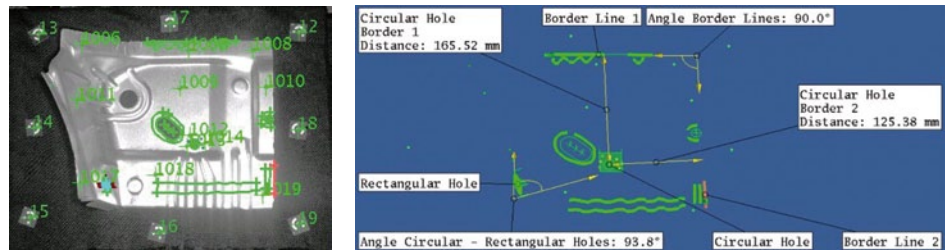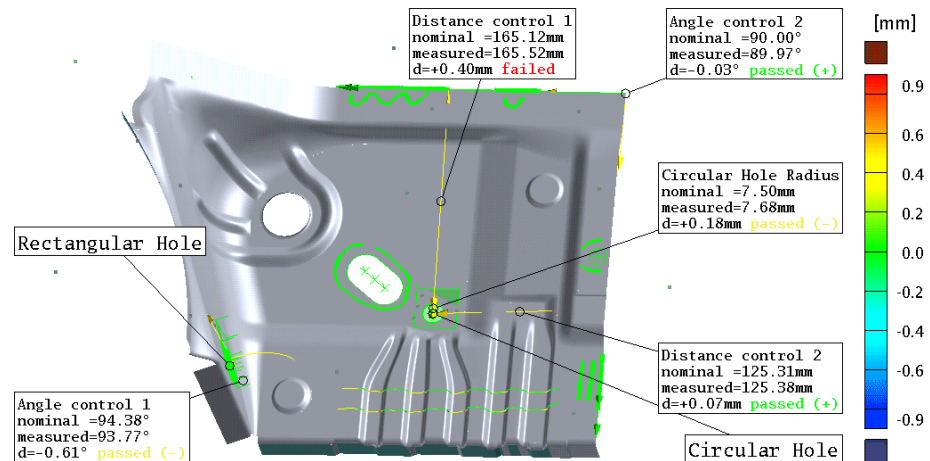

Fig. 2: TRITOP^{CMM} measuring results

Fig. 3: Evaluation of the measuring data in TRITOP^{CMM}. The current measuring data is shown in green. The labels contain the measuring values to be documented including their tolerances with respect to the nominal (CAD) data. The deviations of the section lines are displayed in color gradients.

Another typical application for the TRITOP^{CMM} system is the measuring of welded swivel-trucks for trains. These swivel-trucks (Fig. 4) are used in many European trains and are, among others, manufactured in Gredelj/Zagreb.

Fig. 4: You can see the finished swivel-truck on the left, the frame with reference points in the middle and two details with marked features on the right.

Fig. 5 shows a person taking photos of the bottom part of the swivel-truck. The TRITOP^CMM software then calculates the measuring values from these images.

Each swivel-truck needs to be measured and delivered with a measuring protocol. For this purpose, when using traditional measuring systems, two people are required who need two and a half ours for the measuring process and half an hour for creating the measuring report.

Fig. 5: Taking photos to measure the connection areas and important dimensions of the swivel-truck.

With TRITOP^CMM and an automated evaluation routine, one person is able to perform the measurement and create the measuring report within forty minutes for such a swivel-truck. About twenty minutes of this time are required to apply the reference points, to mark the characteristic features and to place the scale bars. Recording about fifty images and transfer them to the laptop takes approximately ten minutes. In the remaining ten minutes, the automatic evaluation, the definition of the marker lines, the alignment of the measuring data to the nominal data, the calculation of the deviations and the preparation and printing of the measuring report (Fig. 6) are performed.
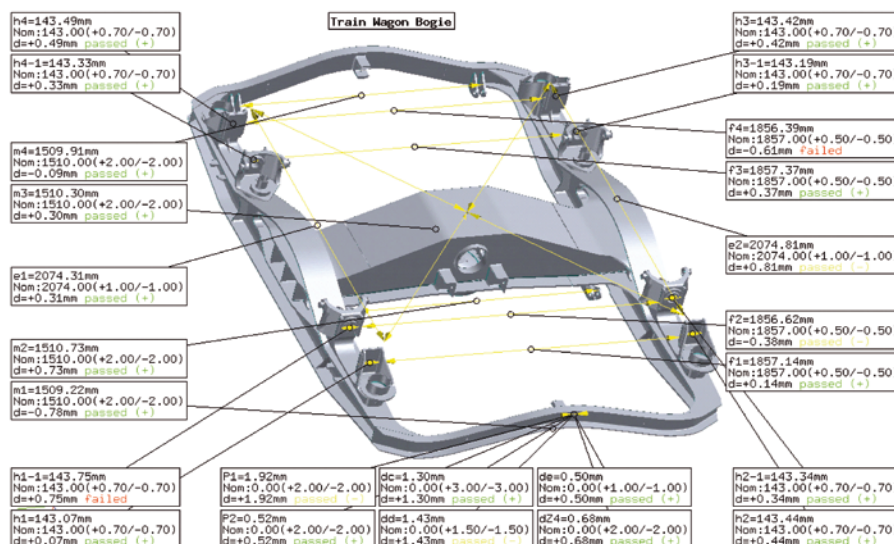

Fig. 6: Example of a measuring report. The deviation to the CAD data are displayed and evaluated (e.g. passed, failed, color markings).

In this application example, TRITOP^{CMM} proved again that traditional measuring tasks can be carried out precisely and efficiently in production.

We would like to thank Volkswagen and TZV Gredelj (Zagreb) for their confidence in our measuring technology and for their willingness to help us understand their measuring tasks.