

Product Report



Model-Based Product Definition

Seeing beyond

PTC and ZEISS Develop Automatic Transfer of Manufacturing Data into Measuring Machine Programming.



Model-Based Product Definition Links Design and Metrology

A Collaboration Between PTC and ZEISS

Model-Based Product Definition

Links Design and Metrology

ZEISS measuring machines are known around the world for their quality and precision. With many industries undergoing digital transformation, the software that controls ZEISS measuring machines is becoming increasingly important. Due to the rise of Model-Based Definitions (MBD), ZEISS was increasingly confronted with the question of how CAD models must be created in the CAD system to guarantee a metrologically correct transfer of the MBD. For this reason, the ZEISS Quality Excellence Center and PTC engaged in a joint knowledge-transfer project. As a result, the last several versions of ZEISS's own CAD-based measuring software, ZEISS CALYPSO, have included an import function that takes Production and Manufacturing Information (PMI) from PTC's Creo CAD models. The goal was to expand this import function so that design and metrology can work together optimally.

ZEISS: Market Leader in CNC-Based Coordinate Measuring Machines

Carl Zeiss Industrielle Messtechnik GmbH is a global market leader in Computer Numerical Control (CNC) coordinate measuring machines and offers innovative technology solutions in more than 32 sales and service organizations worldwide.

The product range includes hardware (portal measuring machines, industrial computer tomographs, surface contour and measuring machines, and microscopes) as well as software, service, and accessories. All system-relevant modules such as the control system, sensors, measuring systems, accessories and software are developed and manufactured in-house, including the CAD-based ZEISS CALYPSO measuring software.

ZEISS Quality Excellence Center: Measurement Services, Training and Technological Innovations

In over 60 ZEISS Quality Excellence Centers worldwide, customers can count on fast solutions for their metrology challenges. Philipp Willier, head of the centers in Cologne and Ostfildern, Germany, says, „We serve customers from many industries with applications ranging from microelectronics to the construction of wind turbines and commercial aircraft. In the ZEISS Quality Excellence Centers, we have the most modern ZEISS measuring machines available for training, measurement services, and customer presentations. We measure and digitize components and support our customers in offline programming and in the application of their equipment.“ The range of services includes consultation on metrological challenges, contract and job measurement, part inspection using computed tomography, and online services to ensure machine availability. The ZEISS CALYPSO measurement soft-

ware can solve virtually any measurement task.

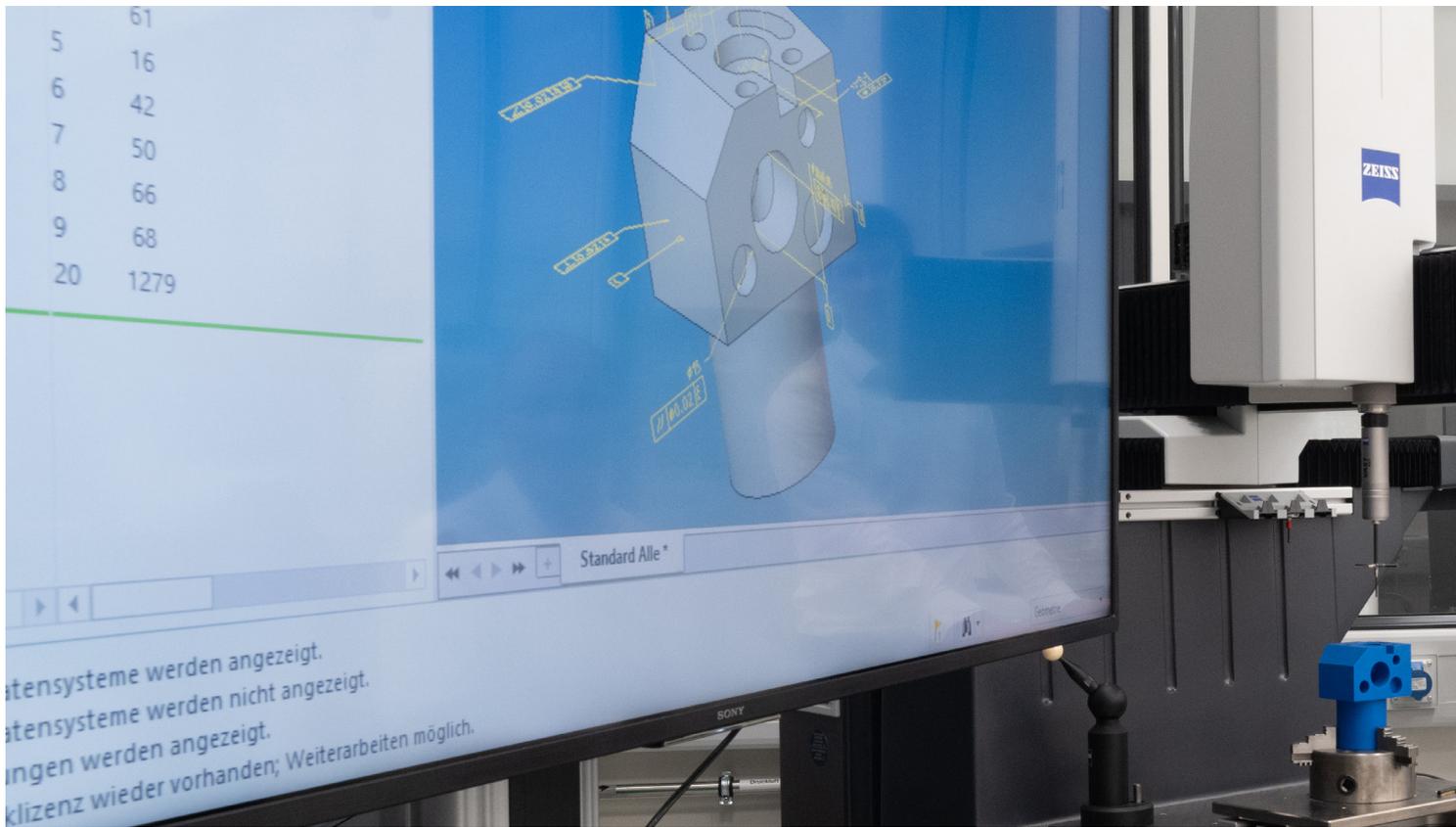
Creating Inspection Plans from 2D Drawings

Until now, the standard procedure for creating inspection plans was to import a 3D model from the CAD system into ZEISS CALYPSO and then use the software to define the measurements based on a 2D technical drawing. For example, a circle could be measured by probing three or more points, and a cylinder by taking circle measurements at different heights.

To carry out this procedure, the user interpreted the 2D drawing and transferred the information to the 3D model and the ZEISS CALYPSO measurement plan. Although the ZEISS CALYPSO measuring software provides the user with functionality that simplifies the programming, the procedure is time-consuming and harbors a certain potential for error. A further challenge with this procedure is that 3D geometry, dimensions, toleran-

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ces, and other notes are often defined separately. A drawing is derived based on the 3D geometry, in which dimensions and geometric tolerance specifications are then stored. These dimensions and tolerances become the nominal values for the measurement and are linked to a measuring point in ZEISS CALYPSO.

Creating Measurement Plans Automatically with Model-Based Definition

Model-Based Definition (MBD) technology enable the definition of dimensions and geometric tolerances as PMI directly on the 3D model. MBD data not only replaces the drawing, it is also machine-readable, especially when defined according to the ISO GPS system (Geometric Product Specification).

Large Demand Among Joint Customers of PTC and ZEISS

Beata Schoenberg, product manager for ZEISS CALYPSO and Metrology Standards software, recalls the beginning of the collaboration project with PTC, „Philipp Willier and I got into a conversation with Katrin Schillack from PTC about a year ago about how we could better support our many joint customers in their work. It turned out that MBD had great potential to simplify the process significantly.“ Katrin Schillack, a CAD specialist at PTC, adds, „Many PTC customers use ZEISS measuring devices, and we are hearing the topic of MDB becoming increasingly important in customer discussions. So, it made sense to work together to create the conditions for the data stored in MBD to be used in ZEISS CALYPSO.“

The GPS Standards Require on the Part of the Designer

Schoenberg explains, „The GPS standard requires the designer to rethink when creating dimensions: today, the length of an edge or a theoretical intersection between two surfaces is usually dimensioned – but such ‘dimensions’ cannot be touched with a tactile measurement sensor. PMI should not be defined on the centerline of a cylinder in this case, but it is always a matter of tying dimensions and tolerances to touchable geometric elements.

“For an MBD-compliant PMI definition, one links the information to surface elements. Length dimensions are defined over the two parallel surfaces, and bores are defined on the cylindrical surface. Creo

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checks the PMIs for plausibility in real time during definition and marks nonsensical entries in red.”

Intelligent Interface Between Creo and ZEISS CALYPSO Automates Data Transfer

ZEISS had already integrated a PMI interface and a converter for reading MBD data in the 2016 ZEISS CALYPSO software version. With the help of the PMI information and the associated geometry, the latest ZEISS CALYPSO software version suggests the appropriate measurement strategy. For example, for a cylinder, the software automatically sets the measurement strategy by defining that probing be done in several circles over the length of the cylinder. The complete definition of the measurement characteristics and inspection features in PMI’s measurement plan is automatic. The measurement technician must only define the orientation of the part on the measuring device and the probes or sensors, optimize the sequence of measurements if necessary, define travel paths, and perform a collision check. A simulation with graphical traverse path display makes it easier to check the automatically generated measurement plan. Of course, it is also possible to include only selected PMIs in the measurement.

„A major advantage here is that the ZEISS CALYPSO measuring software also uses the designations of the inspection characteristics from the CAD system,” explains Schoenberg. She adds, „This means that the design engineer and measurement technician always know that they are talking about the same element. And the time savings are impressive; creating each measuring element and each inspection characteristic, including the measuring strategy, used to take about two minutes, which added up when there were dozens

of characteristics on a component.”

Time savings are not the only benefit, the ZEISS CALYPSO measuring software also helps generate a cleanly defined MBD model. Schoenberg explains, “Today, you look through the automatically created inspection plans, optimize the sequence, define travel paths, and can then perform your measurements directly on the corresponding measuring device. In doing so, you can be sure that the automatic inspection in Creo will detect redundant measurements or PMIs that are not tied to a geometry, and the designer will deliver a cleanly defined MBD model.”

PTC and ZEISS: Shared Interest to Further Develop MBD

„PTC and ZEISS have a common interest in developing MBD because ZEISS offers a complete portfolio of networked machines,” says PTC expert Katrin Schillack. „ZEISS is extremely innovative, fast and flexible, and has proven to be an excellent partner for joint development.”

Willier adds, „The topic of GPS requires designers to think about metrology as early as the definition of their geometries. We work in our training courses to awaken this understanding, and the close linking of the designer’s and measurement engineer’s tools supports this.”

Close, Collaborative Partnership Creates Added Value for PTC and ZEISS Customers

Beata Schoenberg adds, „At ZEISS, we have been working with Creo in our design department for many years and therefore have a knowledge advantage here compared to other systems— which is why this collaboration made sense.”

Not only did ZEISS have a deep familiarity

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