

Technical paper

Geometric dimensioning
of a tibial tray



ZEISS Medical Industry Solutions

Quality Assurance for the Highest Medical Standards



Seeing beyond

Quality solutions for all types of implants: Metal – Plastic – Ceramic



Orthopedic implants must function flawlessly even under the most demanding physiological conditions in the human body. It is therefore essential for manufacturers to develop a comprehensive understanding of the materials used (metallic compounds, ceramic, and polymers) and the various biological defense responses that result. One of the most important steps in the metal manufacturing process is assessing the size, form, and location. Other important challenges include technical cleanliness during the manufacturing process, the assessment of material properties, and efficiency gains through minimizing waste.

A particularly exacting aspect is the final check to establish the permissibility of the deviations from the nominal CAD geometry within the manufactured component. As most implants feature finished or polished surfaces, it is necessary to perform a visual quality inspection.

Based on the example of a tibial tray, the following section describes geometric dimensioning performed using the new-generation CMM ZEISS CONTURA, ZEISS VAST XT, ZEISS CALYPSO, and ZEISS PiWeb.

From material to finished product.

Your product must prove its quality in various ways during the metal working process – and versatile tailored quality solutions from ZEISS are ready for deployment at every step of the production chain.

- **Metallography**
for material analysis
- **Quality testing**
of raw parts
- **Incoming goods check**
for efficient inspection of supplied parts
- **In-process inspection**
for monitoring the processing quality and technical cleanliness
- **Testing of size, form, and location**
for final dimensioning
- **Surface analysis**
for final visual check

Dental Implant



Shoulder Implants

- Peripheral Screws
- Glenosphere
- Glenoid Implant
- Humeral Stem



Spinal Implants

- Monoaxial Pedicle Screws
- Spinal Rods
- Intervertebral Disc



Hip Implants

- Acetabular Cup
- Polyethylene Liner
- Femoral Head
- Femoral Stem



Knee Implants

- Femoral Implant
- Tibial Insert
- Tibial Tray



Trauma & Extremities

- Bone Plate
- Bone Screws



Tibial tray of the knee implant: Handling contours with confidence

The tibial tray, like the femoral implant, is made of metal and is thus suitable for measuring with a tactile sensor. Its complex outer contours and hard-to-reach undercuts pose a variety of challenges during the quality assurance process. These can be overcome with the new ZEISS CONTURA CMM, which is joined by the superlative ZEISS VAST XT tactile sensor to ensure high-speed scanning, detailed form evaluation, fast cycle times, and a wonderfully efficient pallet-by-pallet measurement approach. Since the new-generation ZEISS CONTURA supports ZEISS Multi Application Sensor System (MASS) technology, it can be used for additional applications that require optical sensors such as DotScan, LineScan, and ViScan.

Medical technology depends on reliable quality assurance systems, not only in order to meet demanding industry requirements but also because such parts have a major impact on quality of life. It is essential for a tibial tray to work flawlessly for as long as possible, thus avoiding the kind of wear that could lead to replacement, revision, or problems as serious as bacterial infection of the knee joint. Tibial trays must therefore undergo geometrical evaluation and defect inspection as part of a non-destructive approach that delivers fast cycle times and reliable results. Read on to discover just how the new-generation ZEISS CONTURA and ZEISS VAST XT help you meet all these requirements and more.



The tibial tray is located at the bottom of the knee joint

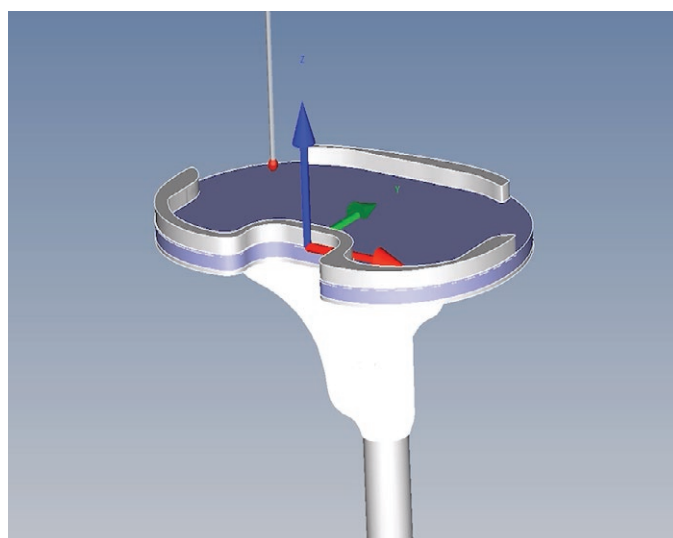
Stylus options for optimized measurement strategies

Get started in ZEISS CALYPSO by creating a plane, 2D line, and symmetry point, all of which are subsequently used to generate a base alignment. Remember that you can always keep the original alignment from the CAD model when doing so. Once you have additionally created a clearance plane by defining the desired edge distances, you can manually execute the new base alignment to show the software how your part is oriented on the

table. Thanks to the instructions provided by ZEISS CALYPSO and the easy guidance of the ZEISS VAST XT sensor via a joystick, this process is quick and effortless.

Part measurement can be performed using a number of different stylus configurations. Not only can your stylus feature a maximum weight of 500 grams and a maximum length of 500 millimeters, ZEISS VAST XT supports all measuring directions and the use of special shapes. ZEISS CALYPSO is also capable of displaying the current position of your stylus: This live view demonstrates that the base alignment is correct and that the software knows exactly how the part is positioned on the table. You can then manually adjust your measurement strategy, for example by clicking on the part display to create points that form a polyline.

At several points during the manual process, such as when creating characteristics, you must first select the required stylus. Having completed this simple task, you are free to generate the elements you need – after adding a trio of points by probing with the stylus, for example, you can have ZEISS CALYPSO automatically turn these into a plane. Users can also activate and adjust settings such as tolerances for greater customization and precision.



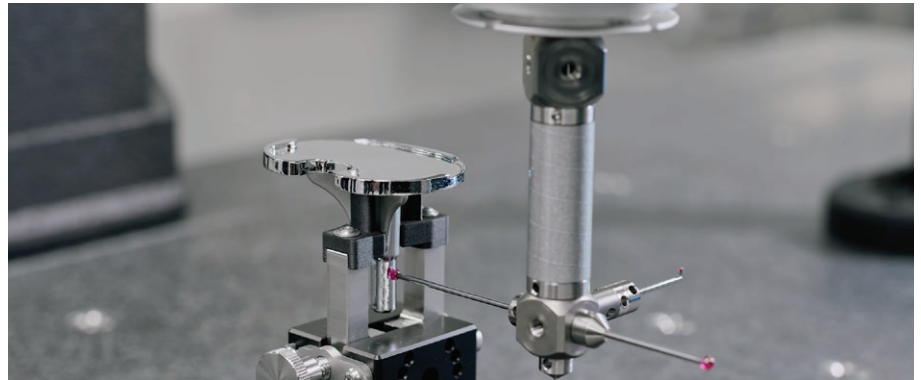
Current position of the stylus as shown in ZEISS CALYPSO

Measurement confidence with ZEISS VAST XT

The measurement of cylinders poses a particular challenge as it requires the use of two separate styli, but ZEISS VAST XT is once again on hand to ensure greater accessibility for hard-to-reach elements such as these. When you select a cylinder as a feature in the CAD display, the software will automatically create a corresponding cylinder view and enable you to activate diameter characteristics. A new circle path can be created in the measurement strategy by selecting the correct stylus and manually configuring settings such as the start angle, start height, speed, and points per section to suit your individual setup.

For optimum results, it is best to perform measurement via multiple circle paths. This can easily be done by duplicating the existing circle path in ZEISS CALYPSO and adjusting the start height and start angle to ensure that these do not overlap in the

visualization. You can then add clearance data by generating another clearance plane and ensuring that the angle range is suitable for your purposes. Having completed setup in the software, just click to confirm and let ZEISS VAST XT take care of the rest.



ZEISS VAST XT scanning the cylinder

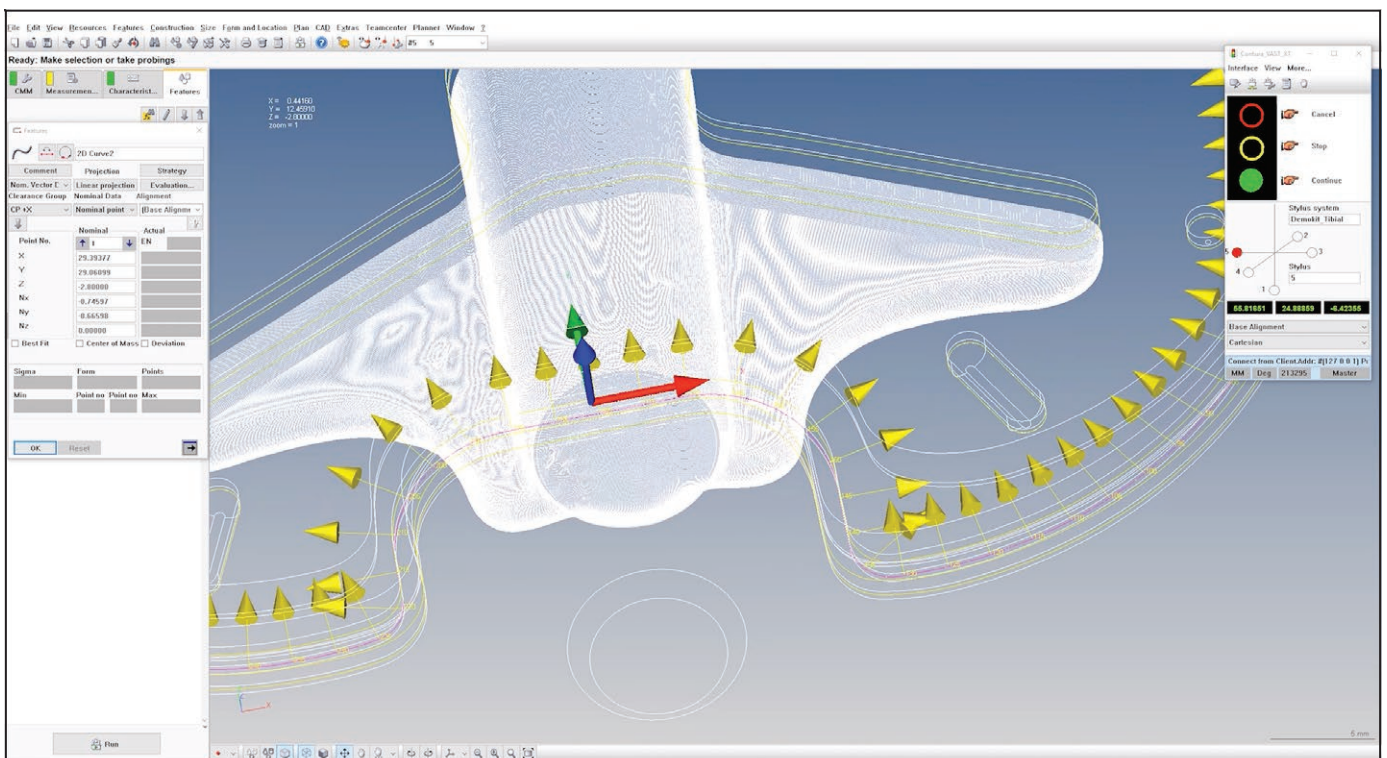
Processing contours and curves in ZEISS CALYPSO

You can execute a freeform curve with ease on the basis of the CAD model. Simply create a cut plane, adjust the position and size, and execute a cut. The element that appears can then be used to generate a curve. The advantage of a freeform curve is that it enables you to precisely dictate the curve along which ZEISS VAST XT should

measure, thereby ensuring more targeted scanning and analysis.

It is also possible to create a curve on the opposite side of the part. Begin by generating an additional curve parallel to the existing one, then delete the superfluous points from this new curve in ZEISS CALYPSO so that only the necessary contours are earmarked for scanning. You can even have the software display the individual point numbers on the screen for

extra confidence when editing these points. Having adjusted the remaining settings and selected the relevant stylus, you can sit back and let ZEISS VAST XT get to work. Of course, measurement and analysis is never truly complete without a protocol. And thanks to the ZEISS PiWeb functionality included as standard in the ZEISS CALYPSO package, curve scans created by the user can be flawlessly transformed into a protocol containing a wealth of essential information.



Display of 2D curve including point numbers

Precision protocols with ZEISS PiWeb

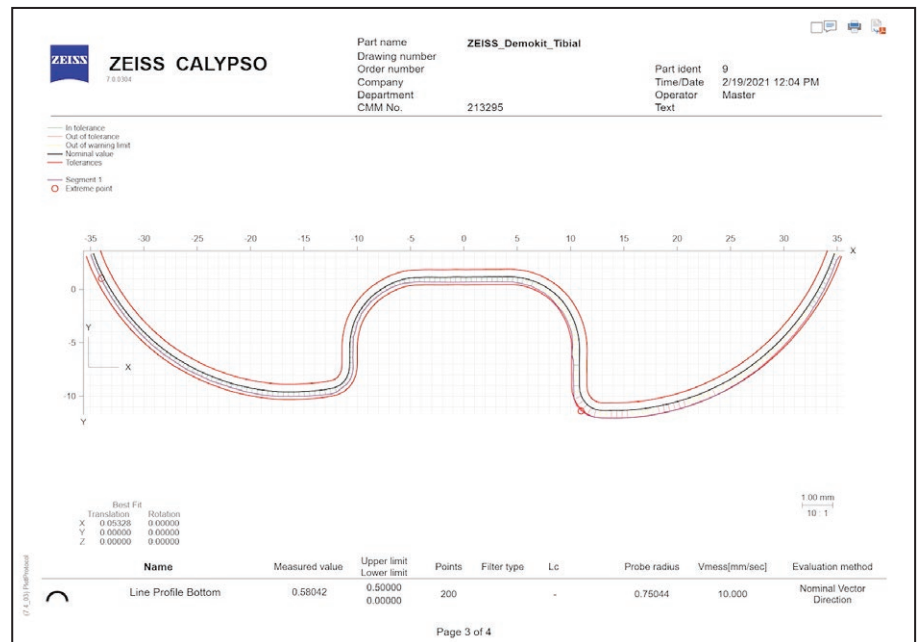
These ZEISS PiWeb reports feature a range of key data such as the measured value, the nominal value, the tolerances, and a color-coded overview of deviations. Further details including the company name, operator name, responsible department, and report generation time are also shown in a clear display.

This delivers a substantial boost in terms of quality assurance: Not only is it more straightforward for users to detect deviations from the nominal value for any of the listed features and characteristics, they can check compliance with the requirements by generating detailed technical drawings based on point-specific data. And with a sizable variety of protocol types on offer in the program, users are free to generate a number of

different protocols for inclusion in a single report.

Whatever form the final protocol takes,

it can easily be previewed, saved as a PDF, or sent directly to a printer. Precision protocols, perfectly portable.



Plot protocol generated via ZEISS PiWeb

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