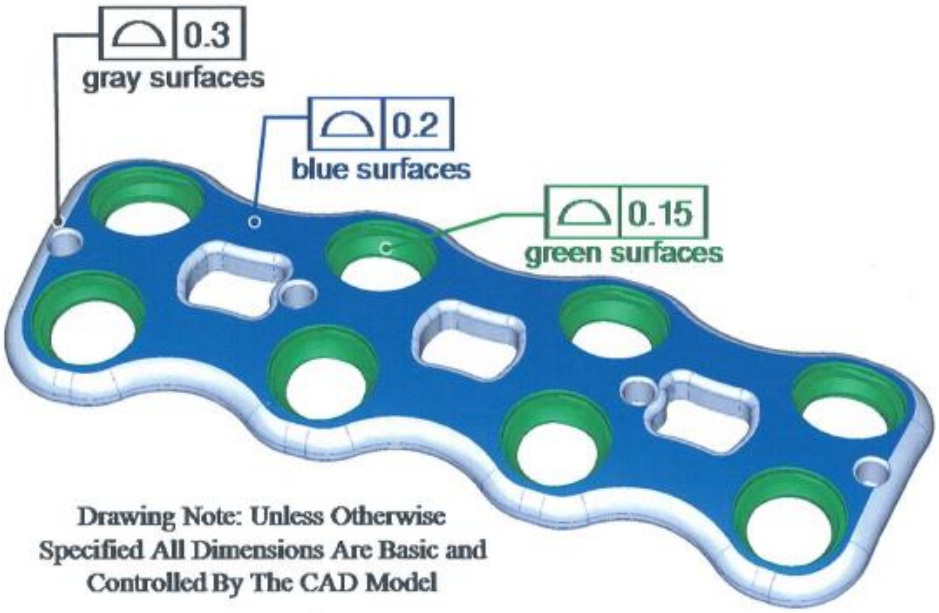
SmartProfile®

3D GD&T Fitting Software

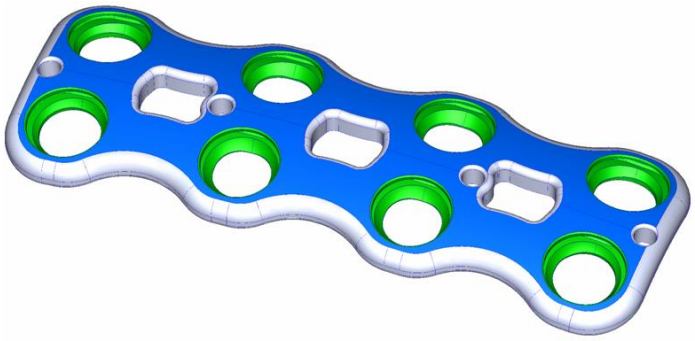


SmartProfile® from KOTEM

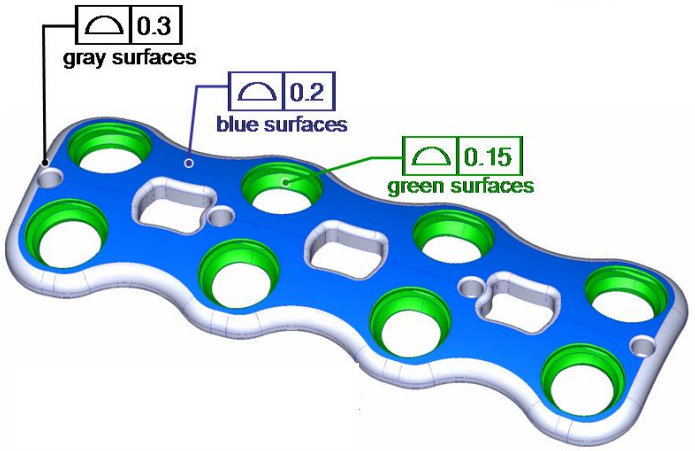
Innovative 3D GD&T Fitting Software

SmartProfile™ takes point clouds of data from part measurements performed on any measurement system and compares them to the nominal CAD model of the part. Every tolerance deviation is shown both numerically and graphically. SmartProfile is extremely powerful yet intuitive, approachable, and easy to use. Here's how it works (It's as easy as 1-2-3-4-5):

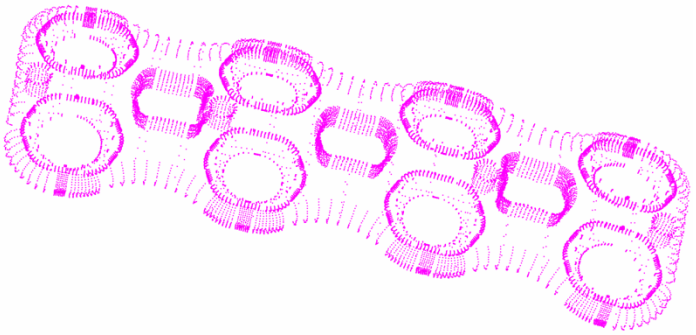
STEP 1: Import the CAD model into SmartProfile



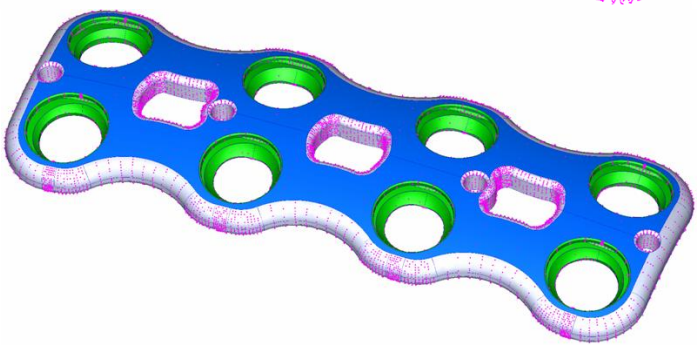
STEP 2: Enter tolerances as called out in the engineering drawing into SmartProfile



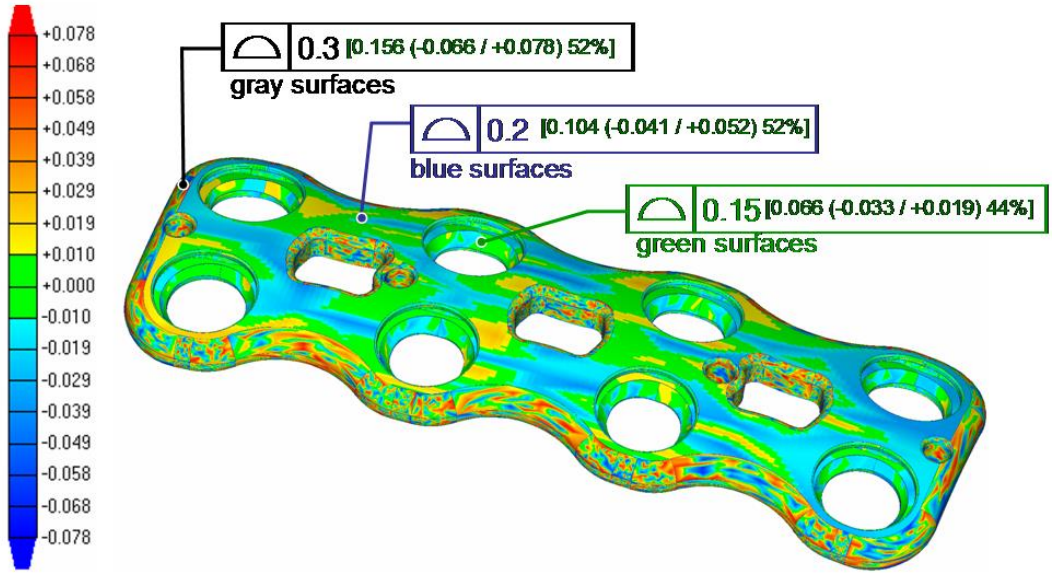
STEP 3: Import measured point array gathered from 3D measurement device data into SmartProfile



STEP 4: Align measured point array with CAD model and analyze results



STEP 5: Show graphical output of results



Summary: Graphical output of Profile Tolerancing. Colored surfaces displayed as topographical map and bar graph shows absolute point deviations.

SmartProfile is the first standalone 2D/3D GD&T automatic software package that is fully compliant with ASME Y14.5 and ISO 1101 standards. Its interactive environment performs intelligent and automatic GD&T evaluation of measured data in accordance with these standards. Since SmartProfile uses ASME & /ISO fitting methods, it's easy to apply engineering print GD&T tolerances to the model and fit the measured data in accordance with industry accepted standards.

Inputs

SmartProfile can accept inputs from several popular CAD formats, including STEP, IGES, VDA, STL, DXF, and MVS files. Some native CAD formats are importable via an optional translation module. SmartProfile accepts measured data from virtually any measuring device with or without tip radius compensation, and with built-in data filters, SmartProfile can accept literally millions of data point

Analysis

SmartProfile's built-in intelligence takes the burden of standards interpretation off the user's shoulders and provides an evaluation solution even in the most difficult cases. SmartProfile uses "zone-fitting" algorithms that optimize the fitting measured points in compliance with ASME & ISO standards. SmartProfile Feature Control Frames are grouped by their Datum Reference Frames and may be evaluated with or without a "simultaneous requirement."

Output

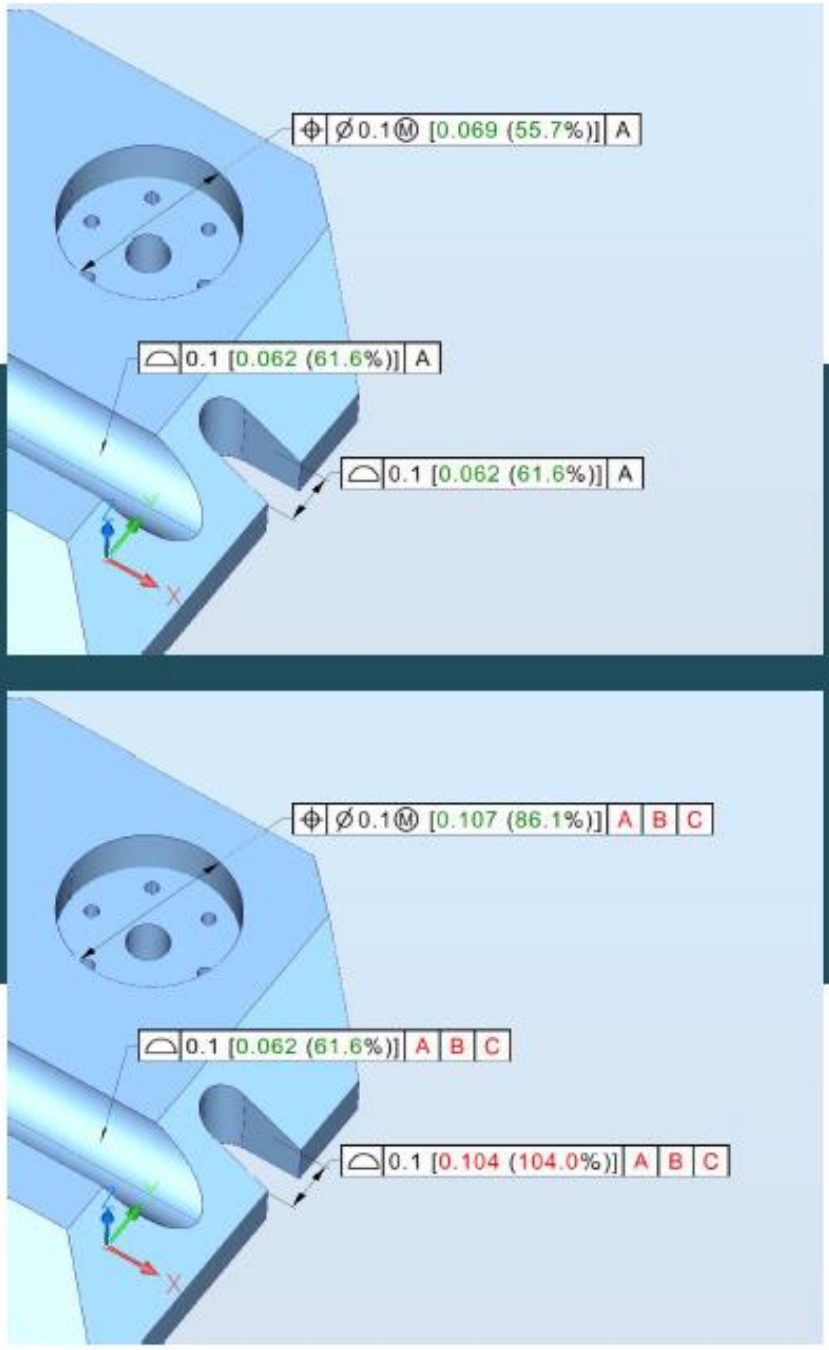
SmartProfile presents pass/fail results for every feature, statistical analysis of all measured points, and easy-to-interpret color maps. Reports may also be exported to several file formats, including PDF, Excel, text and HTML.

Who Needs SmartProfile?

Design

SmartProfile lets design engineers quickly add GD&T datums and tolerances to their CAD models. Before the first part is made, SmartProfile generates point clouds with specified errors and variability, providing an early means of estimating process capability. After the first part is measured, SmartProfile acts as a decision-making tool for part acceptance and a "what if" tool for design improvements. You can quickly and easily open or close tolerances, change datums, and relax or strengthen simultaneity requirements without remanufacturing or remeasuring.

Easy "what-if" testing
SmartProfile makes it easy to see how changing datums affect the biases that prevent taking advantage of the maximum allowed tolerance.



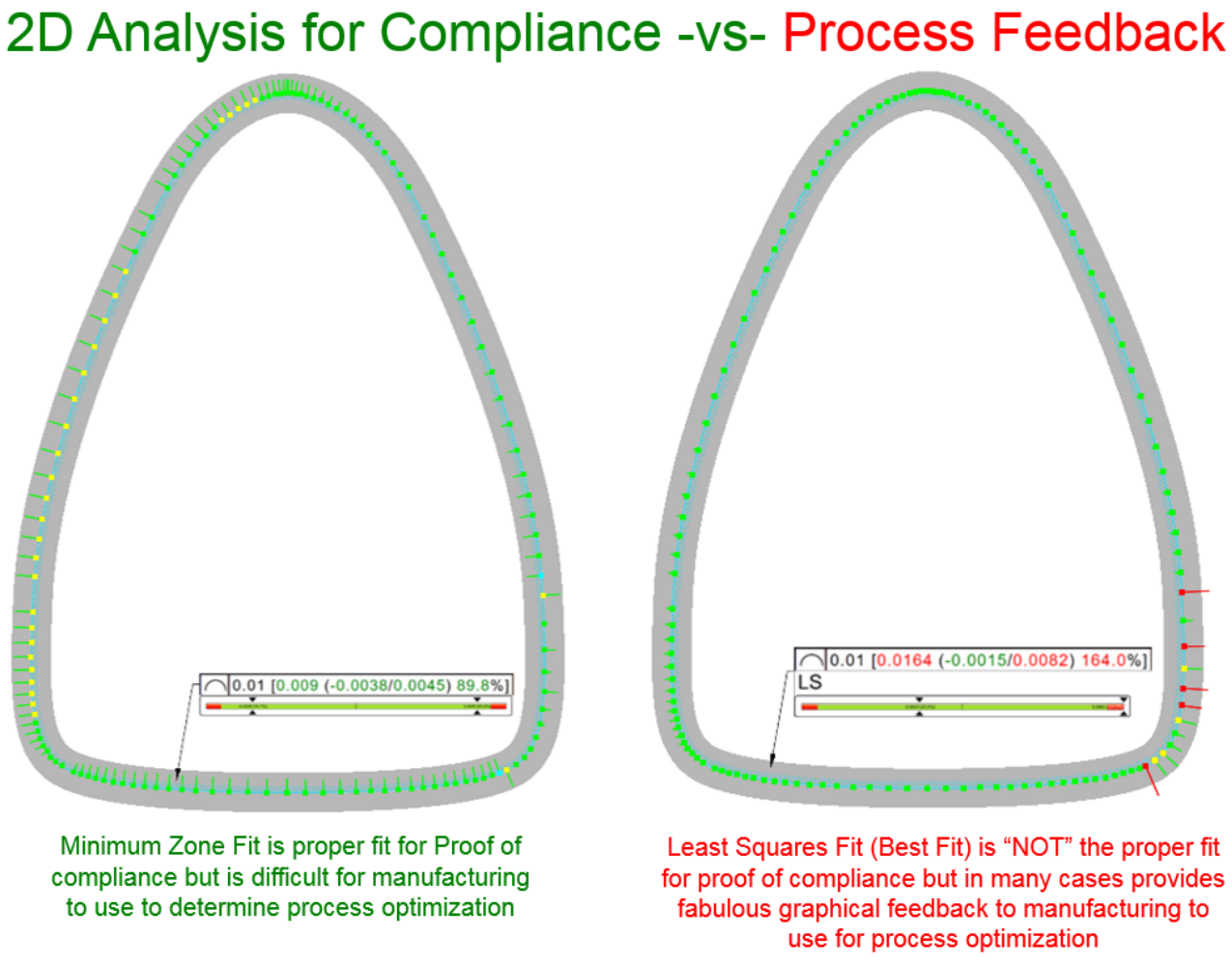
The examples show how a failing tolerance caused by an unneccesary datum can be proven good by releasing non-functional datum constraints.

Manufacturing

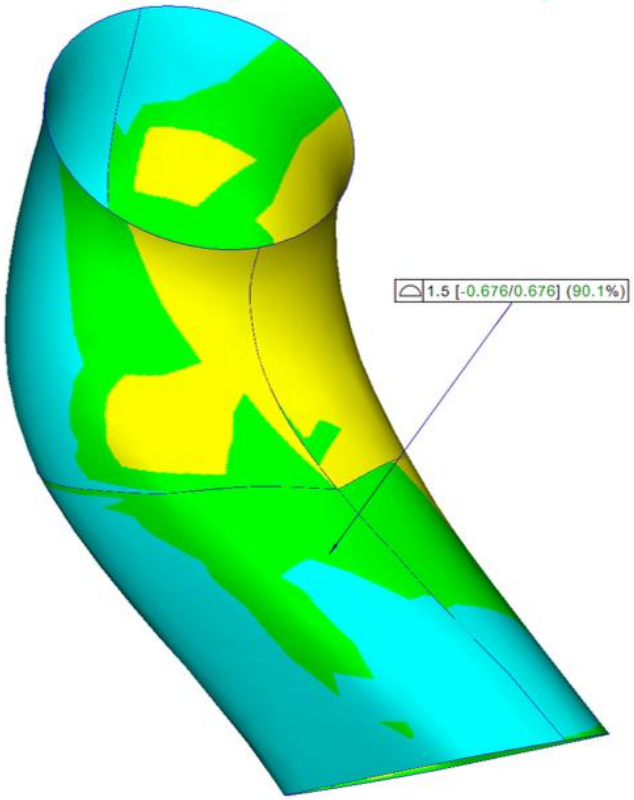
SmartProfile goes beyond mere pages of numbers to describe how a part conforms to its print tolerances. Multiple graphic views show part deviations as color maps, trouble spots.

How often has manufacturing received measurement data from the quality group that has been of little use to aid manufacturing in determining how to solve the manufacturing problem? The 2D example below is an example of the quick analysis that can be completed in SmartProfile to provide value to both quality and to manufacturing. The result on the left is the optimal results quality is looking for from a proof of compliance perspective (minimum zone fit) while the result on the right is what manufacturing is looking for from a process optimization perspective (least squares fit).

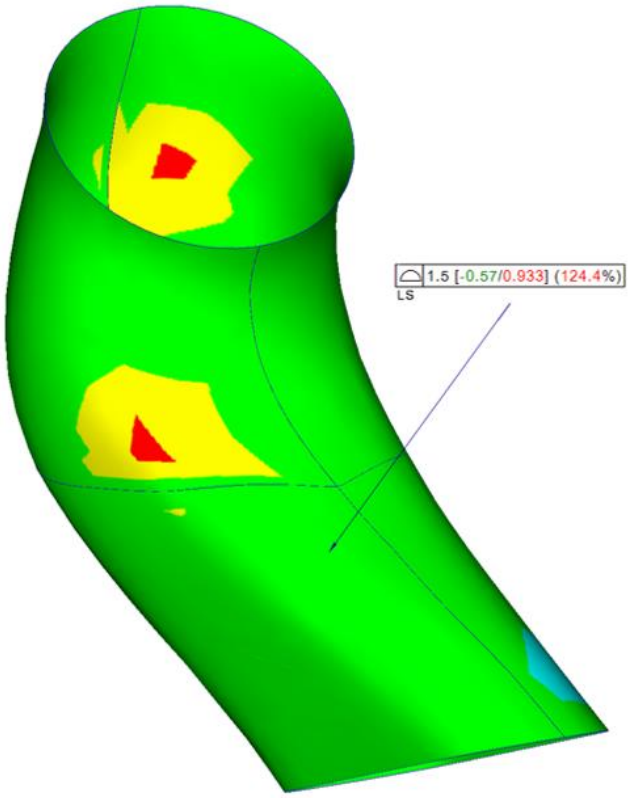
Historically the values (not the graphics) is what manufacturing receives from quality and are based on the default algorithms (least squares) used in the majority of CMM software's used in industry today. The result of this feedback would reject the part (in this case) or show a larger portion of the tolerance used than desired. The implications of this would motivate manufacturing to indicate to design that they are not able to optimally meet the specification tolerance and encourage the design to un desirably increase the allowable tolerance. By proving the graphic on the right it can clearly be seen by the manufacturing engineer that it is only the lower right corner of the part that shows excessive variation would could simply be caused by 1) built up in a molding die, 2) break down in a stamping die, 3) interpolation error in a milling process. It is even possible that it was not a manufacturing problem as it potentially could have been caused by the measurement process due to contamination on the part or build up on a probing sphere. All considerations worth evaluating prior to any consideration of discussing the topic with the designer.



3D Analysis for Compliance -vs- Process Feedback



Minimum Zone Fit is proper fit for Proof of compliance but is difficult for manufacturing to use to determine process optimization



Least Squares Fit (Best Fit) is "NOT" the proper fit for proof of compliance but in many cases provides fabulous graphical feedback to manufacturing to use for process optimization

Quality Assurance

SmartProfile closes the gap between the designer's intentions communicated through the engineering drawings and specification, QA's measurement approach and manufacturing feedback.

Supplier Quality

How many times have customers disagreed with measurement results from suppliers or visa-versa? How many of us can related to parts being rejected that we know still work or parts that are accepted but do not work?

SmartProfile builds a bridge to suppliers who may use measurement equipment different from yours and whose inspectors may be unknown quantities. SmartProfile provides a single analysis tool for both sides of the relationship. Everyone uses the same SmartProfile project, and everyone can agree about datums, tolerances and proper analytical methods. Inconsistent measurement approaches become readily apparent and easy to reconcile. OEMs, suppliers, and third party inspection labs all use the same analysis methods, all use the same ASME Y14.5 and ISO 1101 compliant software, and everyone can agree on the results.

Compliance

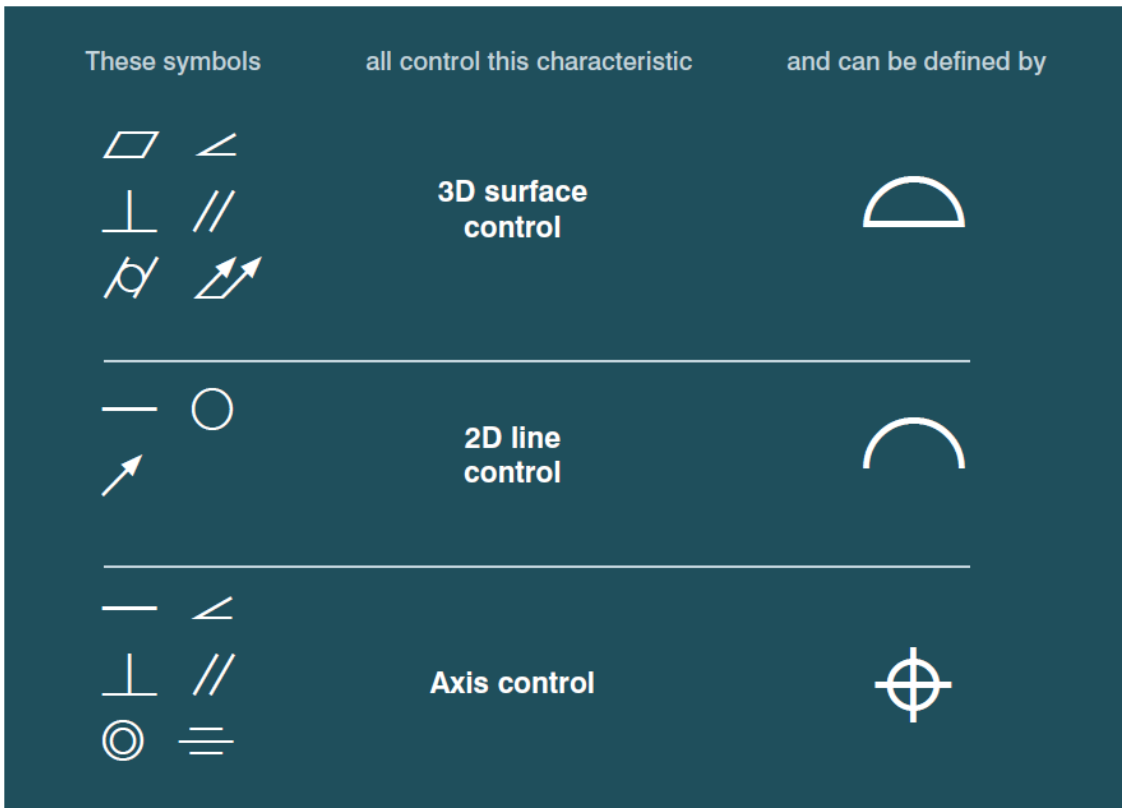
Leading U.S. medical technology manufacturers have validated SmartProfile using sample CAD models and corresponding point clouds with no errors and with errors of known magnitude. With a range of sample models representing the geometry and GD&T of common part designs, later updates to the software are easy to re-validate without long and costly delays

IIGDT and Kotem Canada:

Partnership

IIGDT works hand-in-hand with SmartProfile's developers to implement ensure algorithms are compliant with national standards. We help users get the most out of SmartProfile through live training classes, webinars and self-directed training materials.

Global Simplification: The Global Simplification of GD&T is based on the premise that the 14 GD&T symbols of ASME Y14.5-1994 essentially control three common characteristics: lines, surfaces and axes. The proper application of three symbols: profile of a line, profile of a surface and position provide a simplified GD&T tool box that best conveys design intent, is understandable to manufacturing and practical to measure and quantify"



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