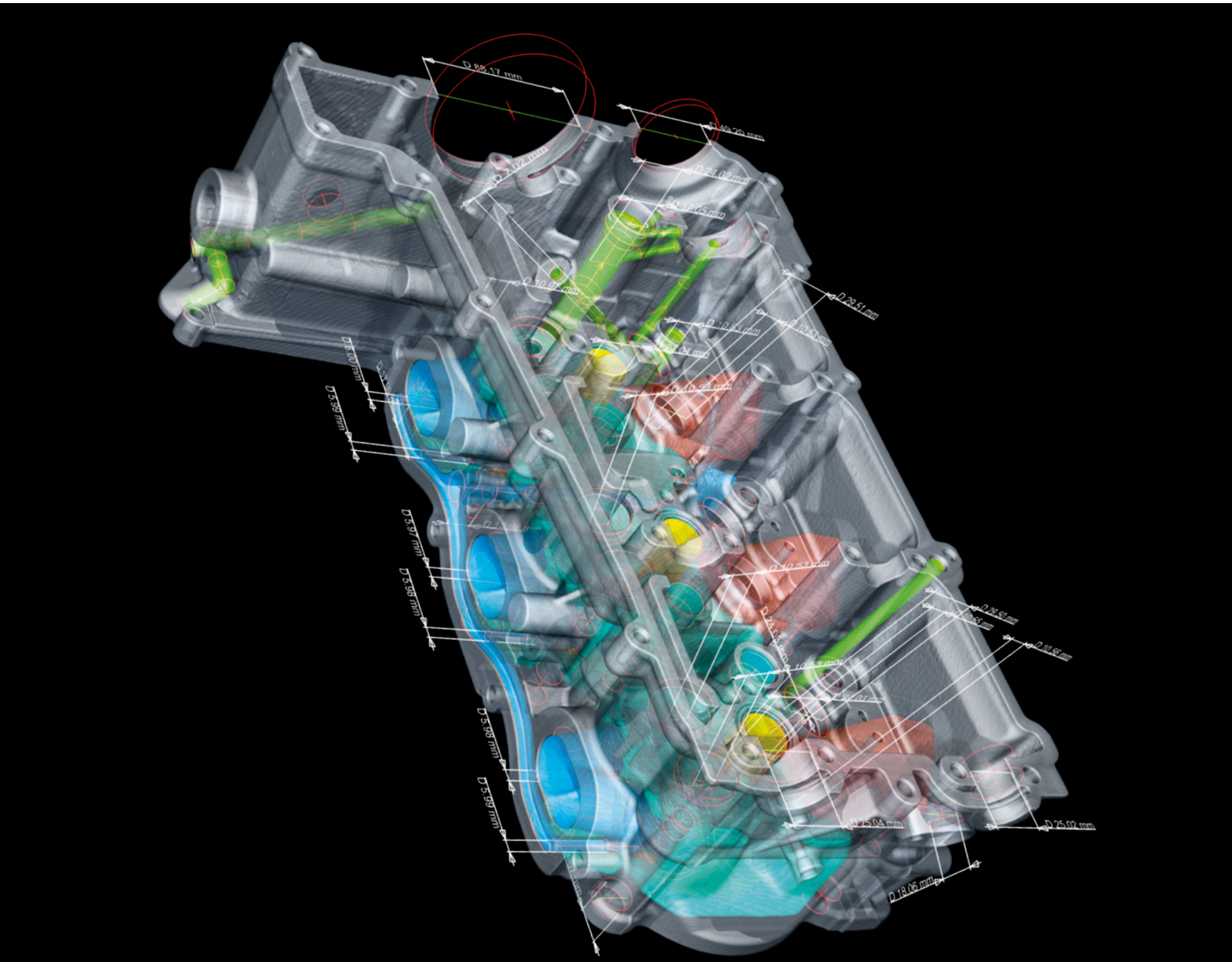
VOLUME GRAPHICS

part of **Hexagon**

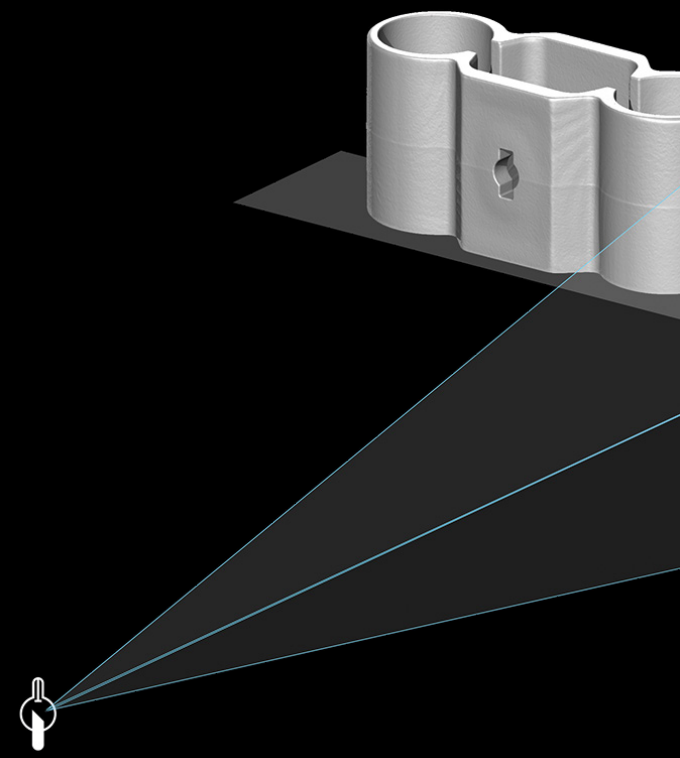


Quality Control in Casting

with Volume Graphics Software

Get Full Control from Mold to Part

with Volume Graphics Software



When you inspect safety-relevant components, every little detail counts. From mold to cast part, from part design to inspection—Volume Graphics software gives you the insights to constantly push the quality boundaries of your cast parts and establish efficient workflows. The software runs on data provided by the latest computed tomography (CT) technology.

Volume Graphics software enables you to identify the most important imperfections in castings, whether caused by the mold or the casting process—quickly, easily, and with incredible accuracy. No matter how complex the shape might be, Volume Graphics allows you to sign off on processes and accurately inspect your cast parts.

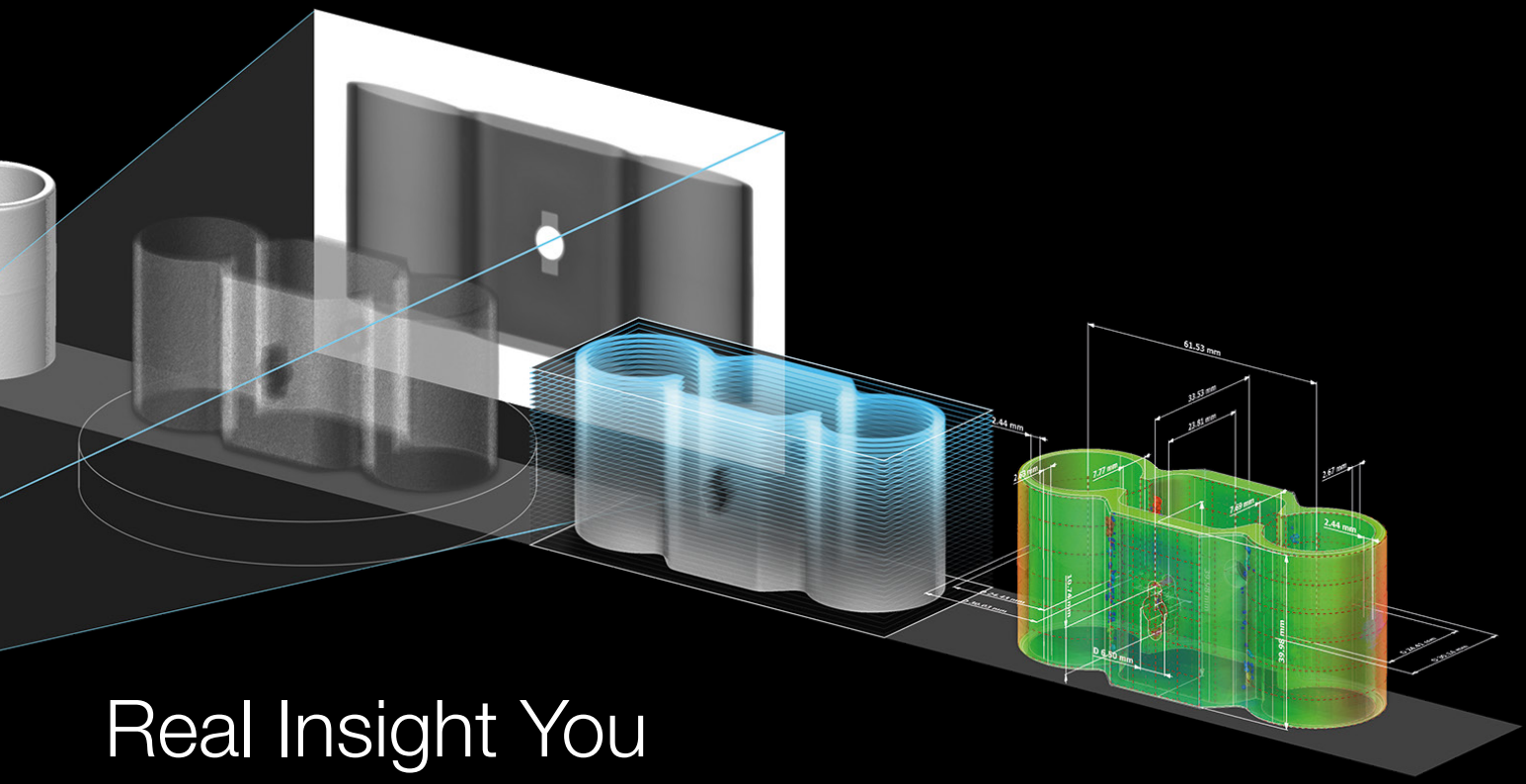
Why CT?

The Most Advanced Technology for 3D Inspection

Whatever it is you're making, CT scanning—when combined with data analysis and visualization capabilities of Volume Graphics software—provides the final word on quality assurance and supply of your casting products to your customers. Because CT reconstruction produces a complete representation of a component in 3D based on a large number of 2D X-ray images, CT allows you to answer even the most complex questions on the external and internal structures of a component and its material properties. The process of CT scanning is fast, sensitive, reliable, non-contact, and non-destructive. You can apply it at any stage of production, from prototyping to even testing inline on the shop floor. With its fully integrated CT reconstruction function, Volume Graphics offers a seamless connection to the comprehensive analysis and measurement functions of its software.

Moreover, the software works equally well with different CT systems from different manufacturers. Most major CT system providers sell Volume Graphics software together with their hardware. In addition, we rely on a worldwide network of distributors to serve our customers around the globe.

Scan for more information:



Real Insight You Can Rely On

By choosing Volume Graphics software, you can rely on more than 20 years of experience in the development of software for non-destructive testing and metrology. Today, a broad range of global customers from the automotive, aerospace, and electronics industries, among others, use Volume Graphics software for quality assurance in product development and production. For this ever-growing community of users, Volume Graphics is the software of choice.

Around the world, customers put their trust in Volume Graphics—not only in our insightful software, but also in our comprehensive consulting, support, and training. Volume Graphics gives its customers a decisive advantage: the ability to gain reliable insights and make better products.

Join them.

Recognized Market Leader

Frost & Sullivan, a leading market research and consulting firm, recognized Volume Graphics in an independent benchmark analysis as market leader in the CT software sector with a market share of about 80 percent in 2017. For its “strong overall performance,” “its singular contributions toward consistently advancing the CT systems market,” and a “thorough understanding of end users’ needs,” Volume Graphics has earned Frost & Sullivan’s 2018 Market Leadership Award.*

* Source: Frost & Sullivan Award Write Up volumegraphics.com/en/frost

Your Comprehensive Toolbox

Measure, Inspect, and Simulate—All with One Software

Volume Graphics offers the tools necessary for CT-based quality assurance across the life cycle of cast components, from designing the part to automatically inspecting it: geometric dimensioning and tolerancing, mold cavity correction, wall thickness analysis, nominal/actual comparison, porosity and inclusion analysis, virtual machining, and stress simulation.

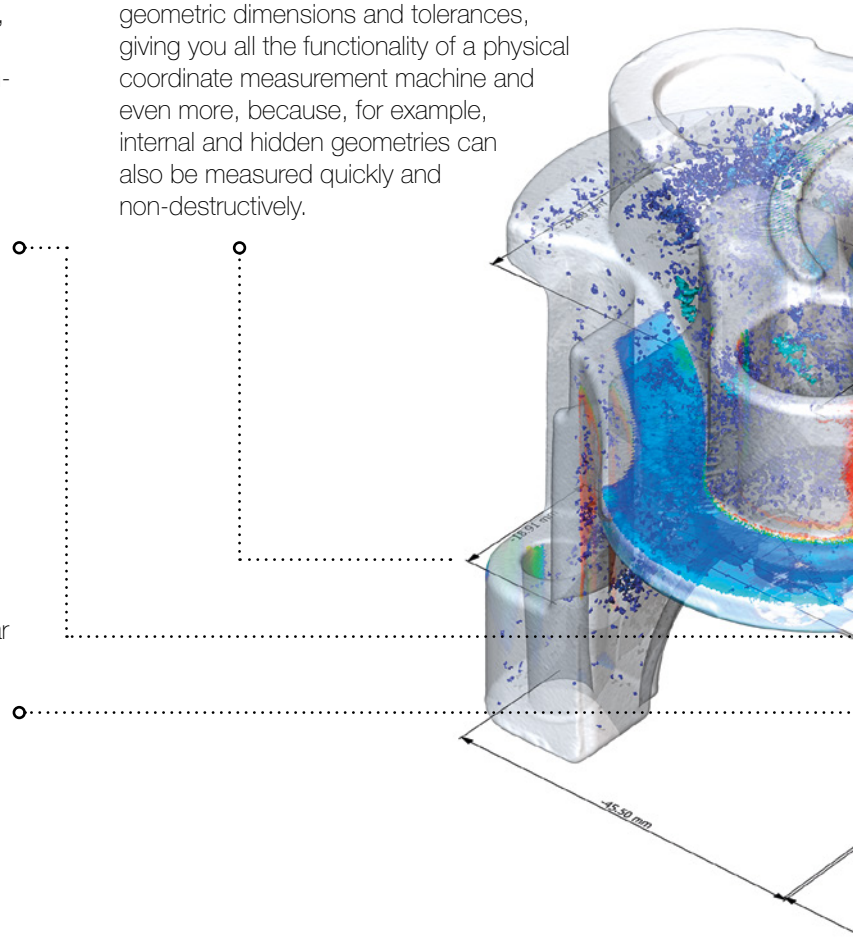
Wall Thickness Analysis

Different wall thicknesses and especially large jumps in wall thickness have a major impact on the flow and solidification behavior of the melt in the mold cavity as well as on the shrinkage behavior including the induced, often unfavorable stresses, the amount, position, and shape of the porosities, and thus on the overall mechanical and physical properties of the casting.

With VGSTUDIO MAX, you can determine the actual wall thicknesses in the casting and thus get an insight into the potential problem areas, e.g., material buildup. You can automatically measure the wall thicknesses or wall distances for almost parallel surfaces as well as for curved or branched surfaces.

Dimensional Measurements

Dimensional deviations are a typical problem of all manufactured parts, including castings. VGSTUDIO MAX allows you to fit geometry elements and create geometric dimensions and tolerances, giving you all the functionality of a physical coordinate measurement machine and even more, because, for example, internal and hidden geometries can also be measured quickly and non-destructively.

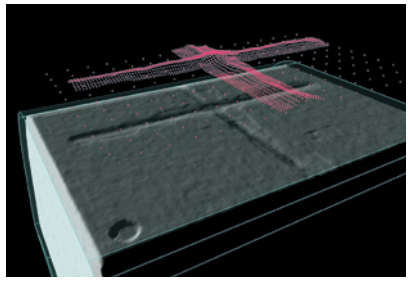


Nominal/Actual Comparison

With VGSTUDIO MAX, you can compare your scanned cast part with its respective CAD data set: For fast detection and evaluation of shrinkage behavior and warpage, of missing or not poured areas of the casting, of sink marks and cold flow issues at castings, or upcoming wear and tear in molds. Color-coded comparisons provide easy-to-understand visual information of deviations. Manual, automated, or rule-based annotations provide local point- or area-based information, for example, to locate the three largest deviating areas or a specific number of predefined points.

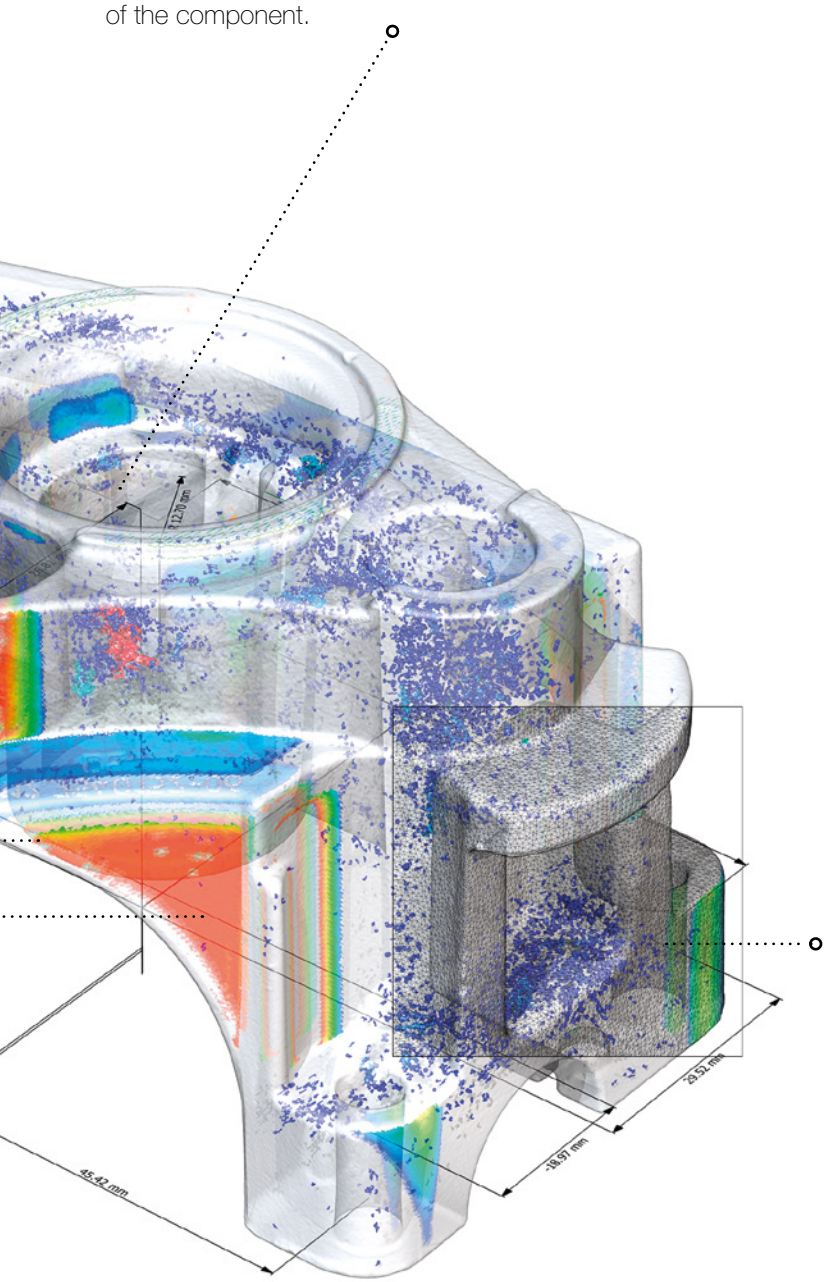
Mold Cavity Correction

The casting mold is often the cause behind geometric deviations of the cast component. With VGSTUDIO MAX, you can correct your casting tools in a seamless digital workflow with a lower number of iterations. Use scans of your sample part to precisely calculate any necessary changes to the mold. Export information on the newly calculated surfaces quickly and easily as a CAD object—and thus create an optimal part/mold fit in just a few steps.



3D Porosity and Inclusion Analysis

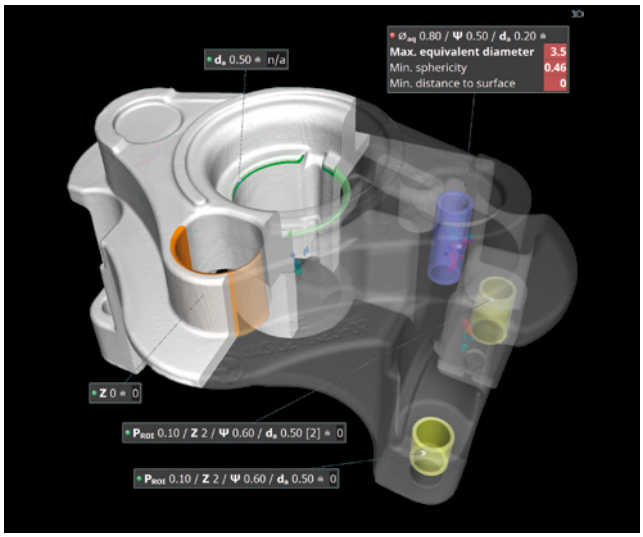
Casting comes with challenges like voids, porosity, and cracks in the final product. With VGSTUDIO MAX, you can reliably detect discontinuities in castings, such as pores and cracks, even in lower-quality data, and determine their sizes and shapes. You can also calculate the defect size relative to the local wall thickness. Filtering the results by properties, such as sphericity, compactness, or distance to surface, allows you to distinguish between different mechanisms of porosity formation, such as air entrapments, gas porosities, and shrinkage cavities. Tolerancing criteria can also be adapted to different regions of the component.



P 201, P 202, and P 203 Analyses

In the automotive industry, special rules for porosity detection apply. VGSTUDIO MAX supports three of the most important guidelines for porosity analysis in order to make evaluations for cast parts easily understandable and reproducible: BDG Reference Sheet P 201, P 202, and P 203.

VDG Specification P 201 (VW 50097) and BDG Reference Sheet P 202 (VW 50093) provide a digital, fully non-destructive take on the classic micrograph analysis, which was achieved by sawing open the component. The BDG Reference Sheet P 203 not only extends VDG P 201 and BDG P 202 to 3D but also puts an additional focus on the specific assessment of functionally relevant part areas by using freeform regions.

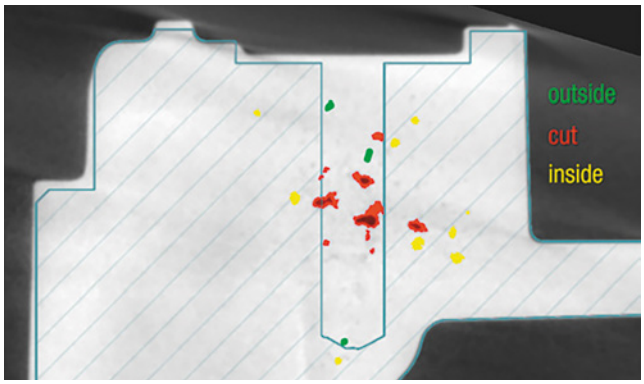


Effect of Defect Simulation

Geometrical flaws and porosity can affect the mechanical strength of a cast part. VGSTUDIO MAX allows you to apply loads and constraints to the CT-scanned model and to simulate and visualize stress concentrations caused by geometrical flaws and porosities—without volume meshing, without prior simulation experience, and without leaving the familiar software environment of VGSTUDIO MAX.

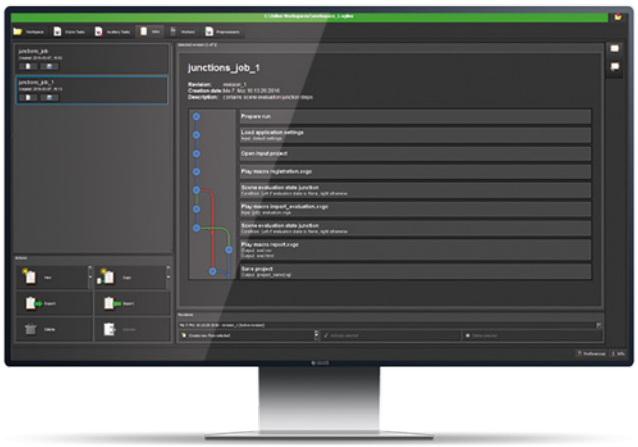
FEA (Finite Element Analysis) or FAT (Fatigue Simulations) reveal aspects of a casting that are not visible in a static analysis of its properties and imperfections. For simulation in third-party software, you can use VGSTUDIO MAX to quickly create high-quality tetrahedral volume meshes that take into account and represent the actual geometries and internal discontinuities of the casting.

A loss of geometrical information is avoided by the omission of an interposed surface meshing, which at the same time saves a lot of time. Each cell of the generated volume mesh can be loaded with simulation-relevant information, such as data from a porosity analysis.



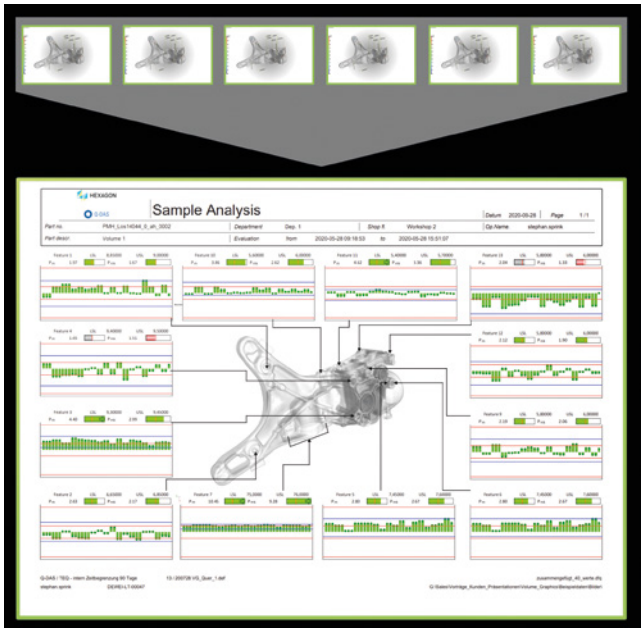
Virtual Machining

Porosities in the wrong places can have serious consequences for the further machining of a casting. That's why VGSTUDIO MAX shows you if and how porosities like gas pores, air entrapments, or shrinkage cavities would be cut during machining—before actually machining the part (CAD file of the part required).



Automated Inspection in Production

It is becoming increasingly important for parts to be not only inspected comprehensively but also directly where they are produced. With VGinLINE, you can semi- or fully automate the quality control process of cast parts (including the automatic recognition of tool cavity markers). It can cover the entire process from reconstruction of the CT data to inspection, reporting, and manual review.



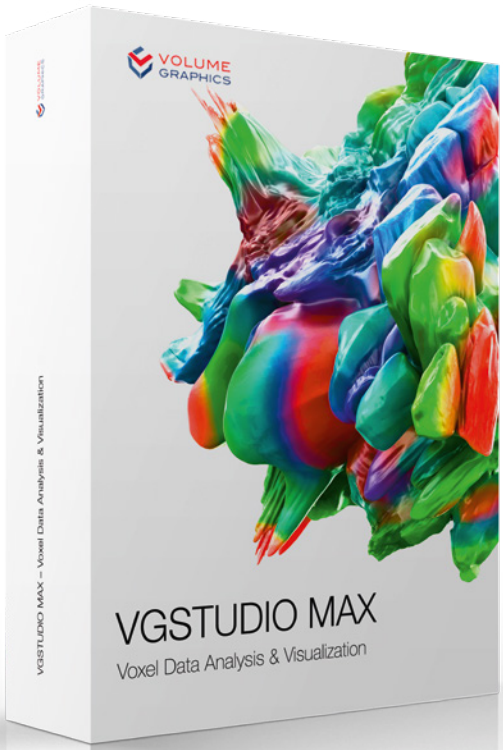
Connection to Auxiliary Systems

Not only can the quality control process of cast parts be semi- or fully automated. It can also be connected to auxiliary systems like statistics, ERP, or MES software via standard file formats. To centrally store CT results in quality management or statistical process control software, you can export certain analysis results using the widely used Q-DAS data exchange format.

Scan for more information:

Volume Graphics Advantages

A Proven and Comprehensive Tool That Gives You Instructive Results



Proven

> Reliable detection of critical casting defects (pores, cracks, etc.) even on lower-quality data
> Proven in casting practice by thousands of users
> Implementation of BDG Reference Sheet P 202/P 201 approved by Volkswagen
> Implementation of P 203 functionality, according to the BDG Reference Sheet P 203 for porosity analysis and assessment using industrial X-ray computed tomography (CT)
> Interfaces to leading casting simulation applications to validate simulated porosities with real porosities detected in CT scans

Instructive

> User-defined filtering of relevant porosities, for example by size, shape, or distance to surface
> Easy-to-use, intuitive P 203 functionality with the help of the porosity key, according to BDG Reference Sheet P 203
> Adaptation of tolerancing criteria to different regions of the component
> Calculation of pore size relative to local wall thickness
> Virtual machining to determine surface porosity of the machined part
> Stress simulation directly on the CT scan to determine the effect of porosity on mechanical strength

Comprehensive

> Comprehensive scope of functions for porosity and inclusion analysis, wall thickness analysis, geometric tolerancing, and mold cavity correction in one software
> Seamless transition from manual and semi-automated analyses in the lab to fully automated quality assurance in production, including optional manual operator review

Related Products

> VGSTUDIO MAX
> VGSTUDIO MAX Cast & Mold (Extended) Package
> Coordinate Measurement Module
> Wall Thickness Analysis Module
> Nominal/Actual Comparison
> Manufacturing Geometry Correction Module
> (Enhanced) Porosity/Inclusion Analysis Module
> Structural Mechanics Simulation Module
> VGinLINE

Learn More

Learn more at www.volumegraphics.com/casting or by scanning the QR codes.

Scan to download our brochures:

VOLUME GRAPHICS

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Stay up to date and register for our free newsletter:

Volume Graphics GmbH has subsidiaries in the US, Japan, China, and Singapore. To broaden our global footprint even more, we can rely on a worldwide network of distributors.

Headquarters
Volume Graphics GmbH
Speyerer Straße 4–6
69115 Heidelberg, Germany
Phone: +49 6221 73920-60
Fax: +49 6221 73920-88
sales@volumegraphics.com
www.volumegraphics.com

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