



# Your Pit Stop for Quality

Volume Graphics Software for Quality Control in Casting

# Get Full Control from Mold to Part

With Volume Graphics Software

Just as every millisecond in a pit stop counts in a race, every little detail counts when inspecting safety-relevant components. Volume Graphics is your pit crew. From mold to casted 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.

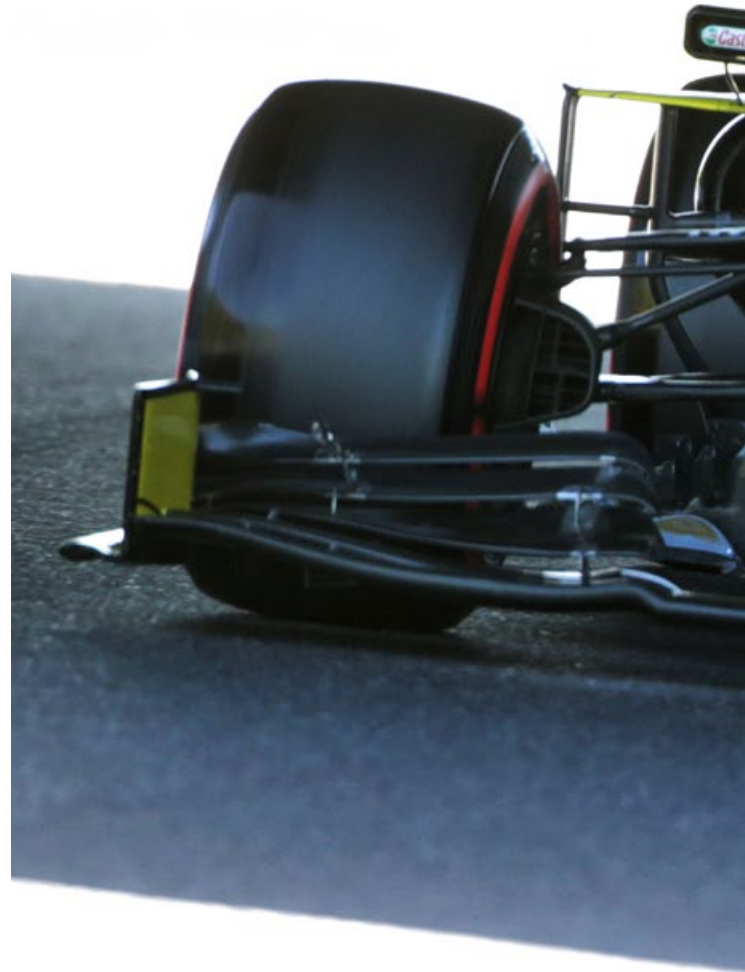
Volume Graphics software enables you to identify the most important casting defects, whether caused by the mold or the casting process—quickly, easily, and with incredible accuracy. No matter how complex the shape might be, Volume Graphics allows you to sign off on processes and accurately inspect your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

## Volume Graphics and Renault F1® Team

Follow Renault F1® Team's lead and rely on Volume Graphics' inspection expertise: As part of a multi-year agreement, Volume Graphics is proud to support Renault F1® Team. Since 2016, Renault F1® Team has used VGSTUDIO MAX to analyze and visualize CT data. CT and Volume Graphics have since then contributed to a significant increase in the analysis capabilities of Renault F1® Team's test laboratory.

## 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.



OFFICIAL SUPPLIER

Around the world, customers such as Renault F1® Team 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.



Scan for more information:



## 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](http://volumegraphics.com/en/frost)

# Your Comprehensive Toolbox

Measure, Inspect, and Simulate—All with One Software

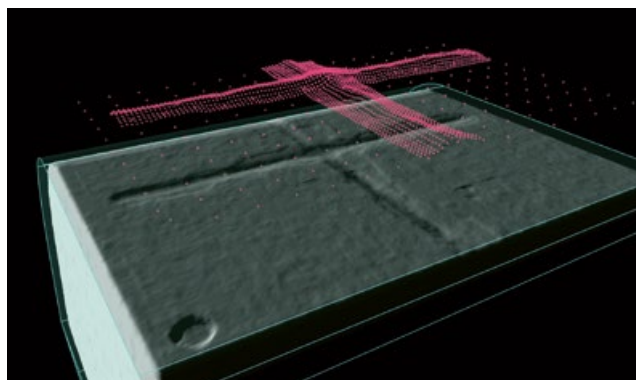
Volume Graphics software is your tool for identifying the most important casting defects such as porosity, inclusions, shrinkage, and warpage. Volume Graphics offers the tools necessary for CT-based quality assurance across the life cycle of cast components, from designing the part to automatically inspecting it: geometric dimensioning and tolerancing, mold cavity correction, wall thickness analysis, nominal/actual comparison, defect detection, virtual machining, and stress simulation.

## 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 more. Geometric deviations of your scanned cast part from its respective CAD data set become visible at a glance when you perform a nominal/actual comparison.

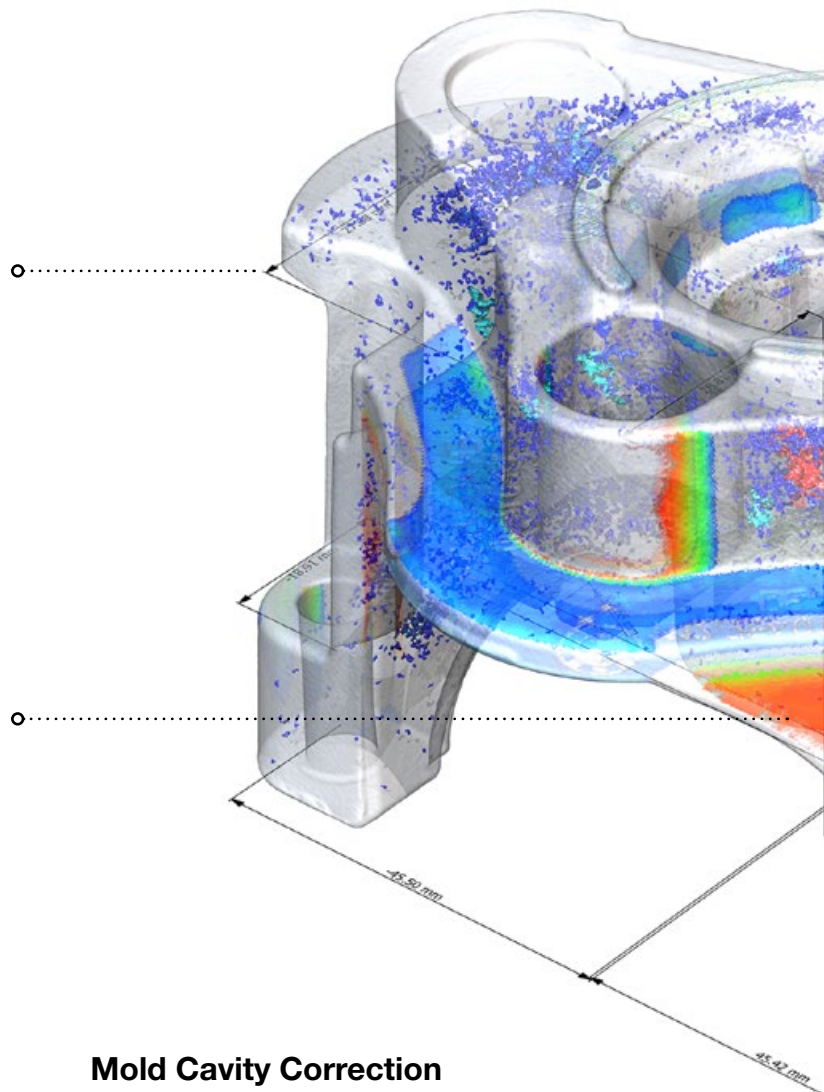
## Wall Thickness Analysis

Wall thickness influences the behavior of the melt front and the homogeneity of the temperature in the part during filling and cool down. With VGSTUDIO MAX, you can determine the actual wall thickness, which gives you more insight into potential problems that can cause warpage. You can quickly and automatically measure wall thickness or gap width for near parallel surfaces (ray method) as well as for complex curved or branching surfaces (sphere method).



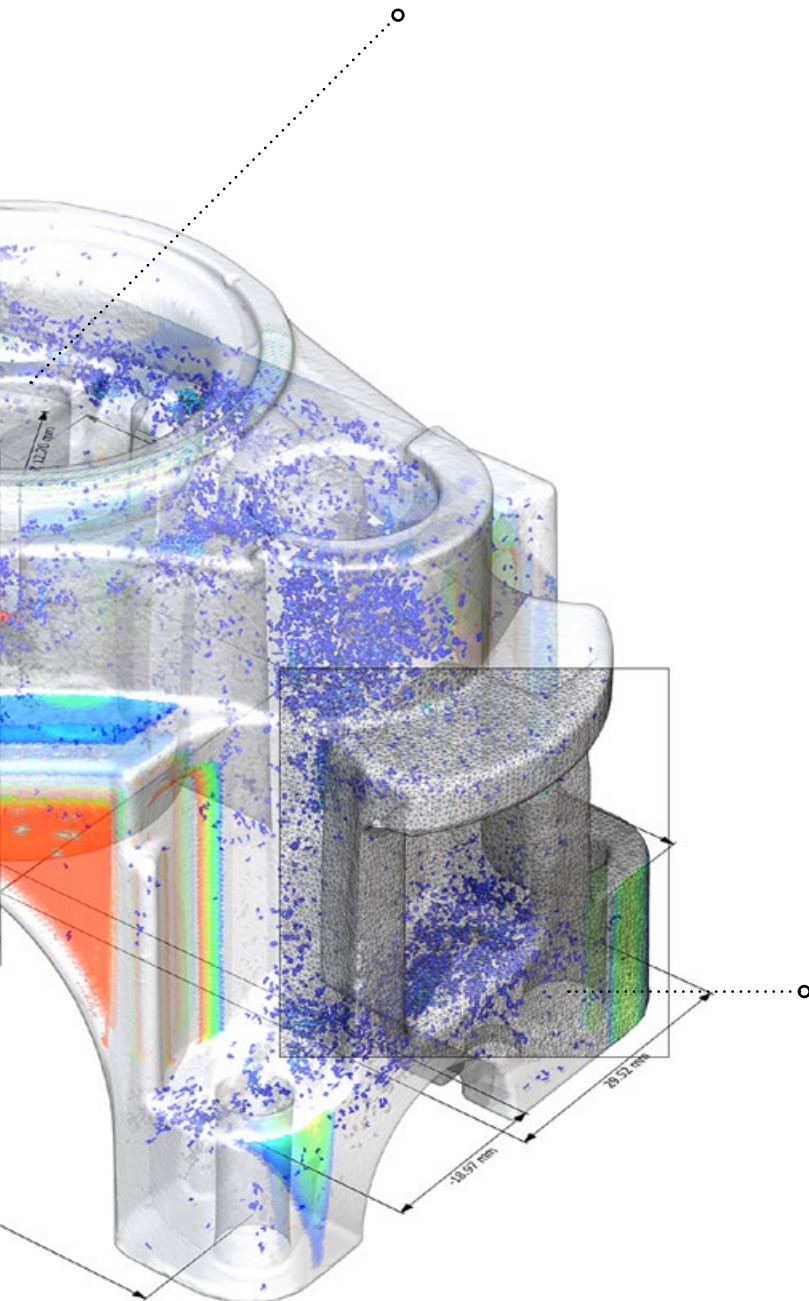
## Mold Cavity Correction

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.



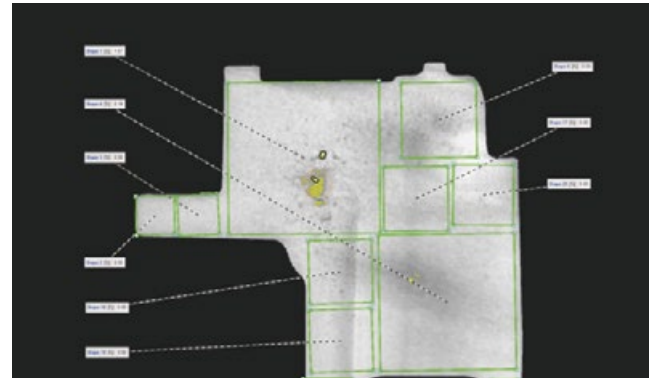
## 3D Porosity Inspection

Casting comes with challenges like voids, porosity, and cracks in the final product. With VGSTUDIO MAX, you can reliably detect critical casting defects, 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 defects by properties such as sphericity, compactness, or distance to surface allows you to distinguish between defect formation mechanisms. Tolerancing criteria can also be adapted to different regions of the component.



## P 202/P 201 Porosity Inspection

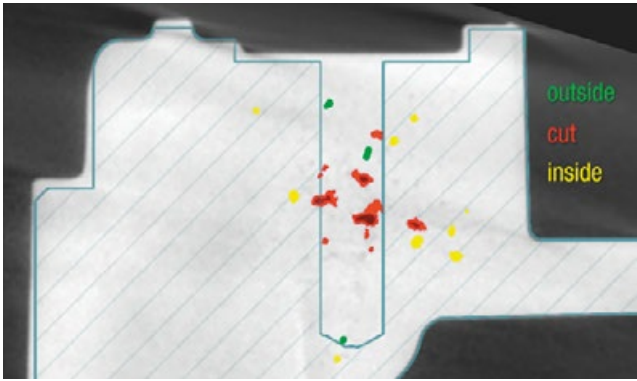
In the automotive industry, special rules for defect detection apply. VGSTUDIO MAX implements the VDG rules P 202 and P 201, which are also approved by Volkswagen (MW 50093/MW 50097). This allows you to quantify the surface size of defects in CT slice images automatically and eliminates the need for the time-consuming production of micrograph sections and the preparation of samples in many cases.



## Effect of Defect Simulation

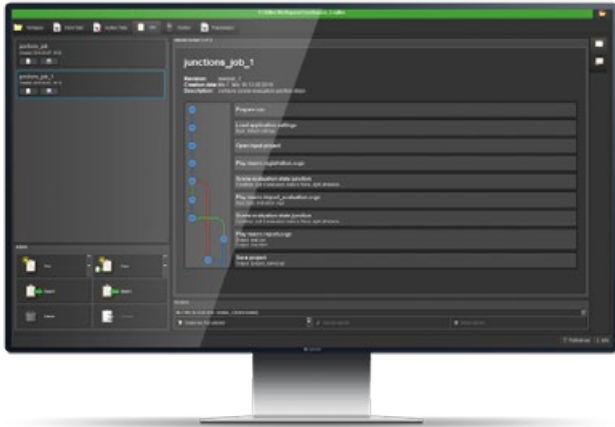
Geometrical flaws and porosity can affect the mechanical strength of a cast part. The VGSTUDIO MAX Structural Mechanics Simulation Module allows you to apply loads and constraints to the CT scanned model and to simulate and visualize stress concentrations caused by geometrical flaws and pores—without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

For detailed analyses by your simulation department, VGSTUDIO MAX creates high-quality tetrahedral volume meshes that you can then use in third-party software. These high-quality tetrahedral volume meshes represent the actual geometries and internal defects of the cast part. You can augment each cell of the volume mesh with additional information required for simulation, such as porosity volume fractions. To reduce the volume mesh size and thereby the simulation time to a workable level, you can use the Structural Mechanics Simulation Module to preselect critical pores for volume meshing.



## Virtual Machining

Pores 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 pores 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 inspected as comprehensively and non-destructively as possible 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).

VGINLINE is a ready-to-use framework that relies on the advanced capabilities of VGSTUDIO MAX. It can cover the whole process from reconstruction of the CT data to inspection, reporting, and manual review. Its modular architecture makes it easy to tailor it to specific scenarios. VGINLINE combines analyses and any other required data, such as report configurations or reference models, into a single inspection plan.



Scan for more information:

# Why CT?

The Most Reliable Technology for 3D Inspection

Computed tomography (CT) data provides a comprehensive view of the cast part because of its ability to accurately represent both surfaces and inner structures. In combination with VGSTUDIO MAX, CT offers the unique possibility of getting a full understanding of a part's quality.

Because CT reconstruction produces a complete representation of a component in 3D based on a large number of 2D X-ray images, CT allows the user to draw conclusions on the external and internal structures of a component and its material properties. Thus, CT can answer more complex questions than tactile or optical inspection methods. With its fully integrated

CT reconstruction function, Volume Graphics offers a seamless connection to the comprehensive analysis and measurement functions of its software.

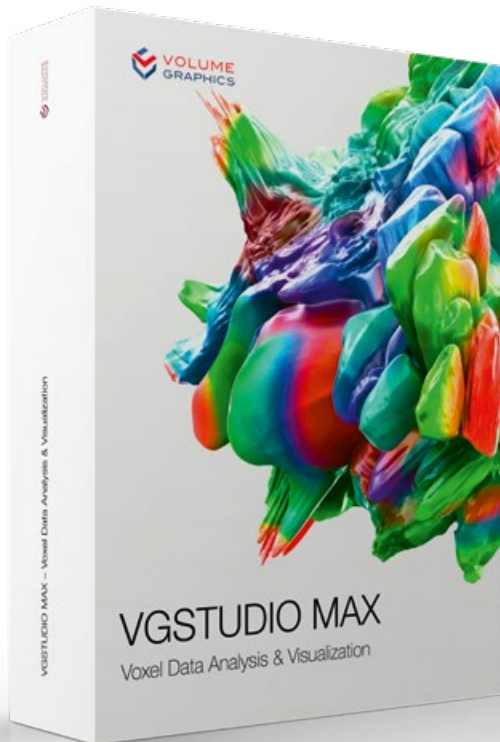
Moreover, the software works equally well with different CT systems from different manufacturers. Most major CT system providers sell Volume Graphics software together with their hardware. In addition, we rely on a worldwide network of distributors to serve our customers around the globe.



Scan for more information:

# 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 hundreds of users
- > Implementation of VDG/BDG Guideline P 202/P 201 approved by Volkswagen
- > Interfaces to leading casting simulation applications to validate simulated porosities

## Instructive

- > User-defined filtering of relevant defects, e.g., by size, shape, or distance to surface
- > Adaptation of tolerancing criteria to different regions of the component
- > Calculation of defect 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 defect detection, 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](http://www.volumegraphics.com/casting)  
Or by scanning the QR codes.

Scan to download  
our brochures:





**VOLUME  
GRAPHICS**

Enabling better products



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](mailto:sales@volumegraphics.com)

[www.volumegraphics.com](http://www.volumegraphics.com)

© 2019 Volume Graphics GmbH, VGL is a registered trademark of Volume Graphics GmbH, Germany. All company, product, or service names mentioned in this brochure are used for identification purposes only and may be trademarks of their respective owners.