

Analyzing, testing, measuring

With Volume Graphics software for industrial CT

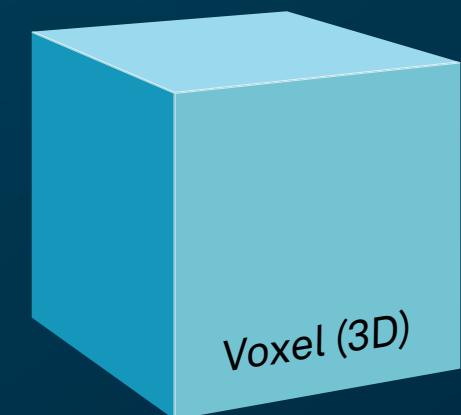
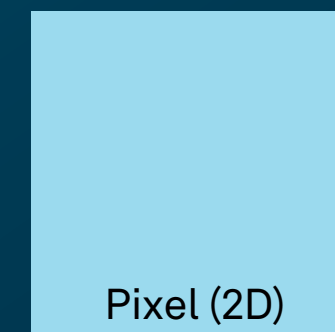


Why CT?

The most advanced technology for 3D inspection

Whatever it is you're making, industrial computed tomography (CT) scanning — when combined with the data analysis and visualization capabilities of VG software — provides the final word on quality assurance and delivering competitive products to your customers. By accurately representing both outer surfaces and inner structures, CT offers the unique possibility of gaining a holistic view of product quality, whether that product be an engine block or solder joints on printed circuit boards.

Because CT reconstruction produces a complete representation of a component in 3D comprising many 2D X-ray images, CT allows you to answer even the most complex questions about 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 testing inline on the shop floor. The variety of potential applications for industrial CT data analysis is vast and ever-growing.

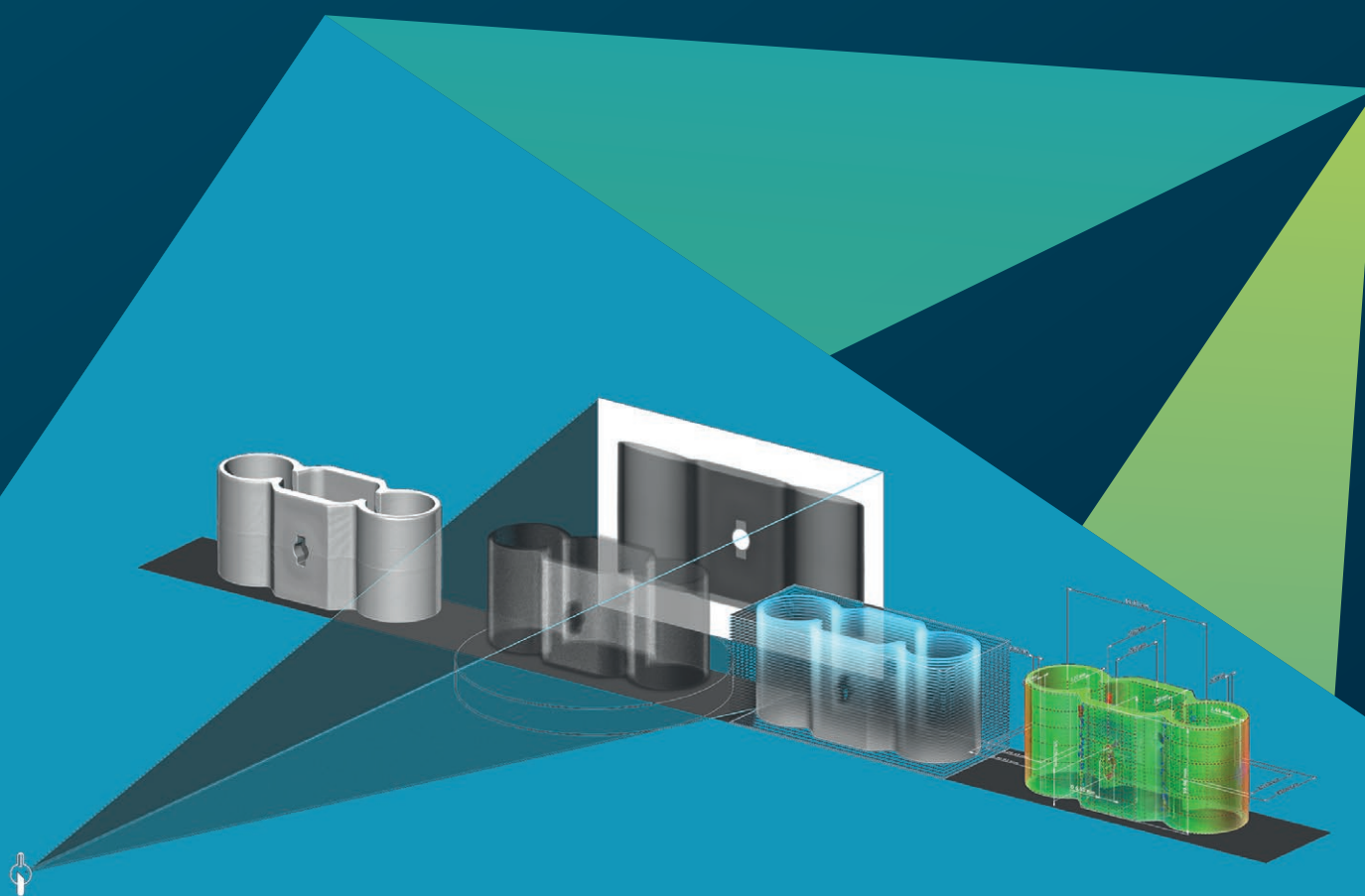


The voxel is key to the CT scan. When an X-ray beam's high-energy photons pass through their target — your product — some are absorbed and others scatter, while the rest strike the detector screen opposite the X-ray source.

They then energize the (2D) pixels there in proportion to the density of the material being scanned as well as its thickness and attenuation values, generating a series of grayscale images. Our software then reconstructs those millions of pixels into 3D voxels, which make up a full three-dimensional visualization of the scanned object — in other words, its digital twin.

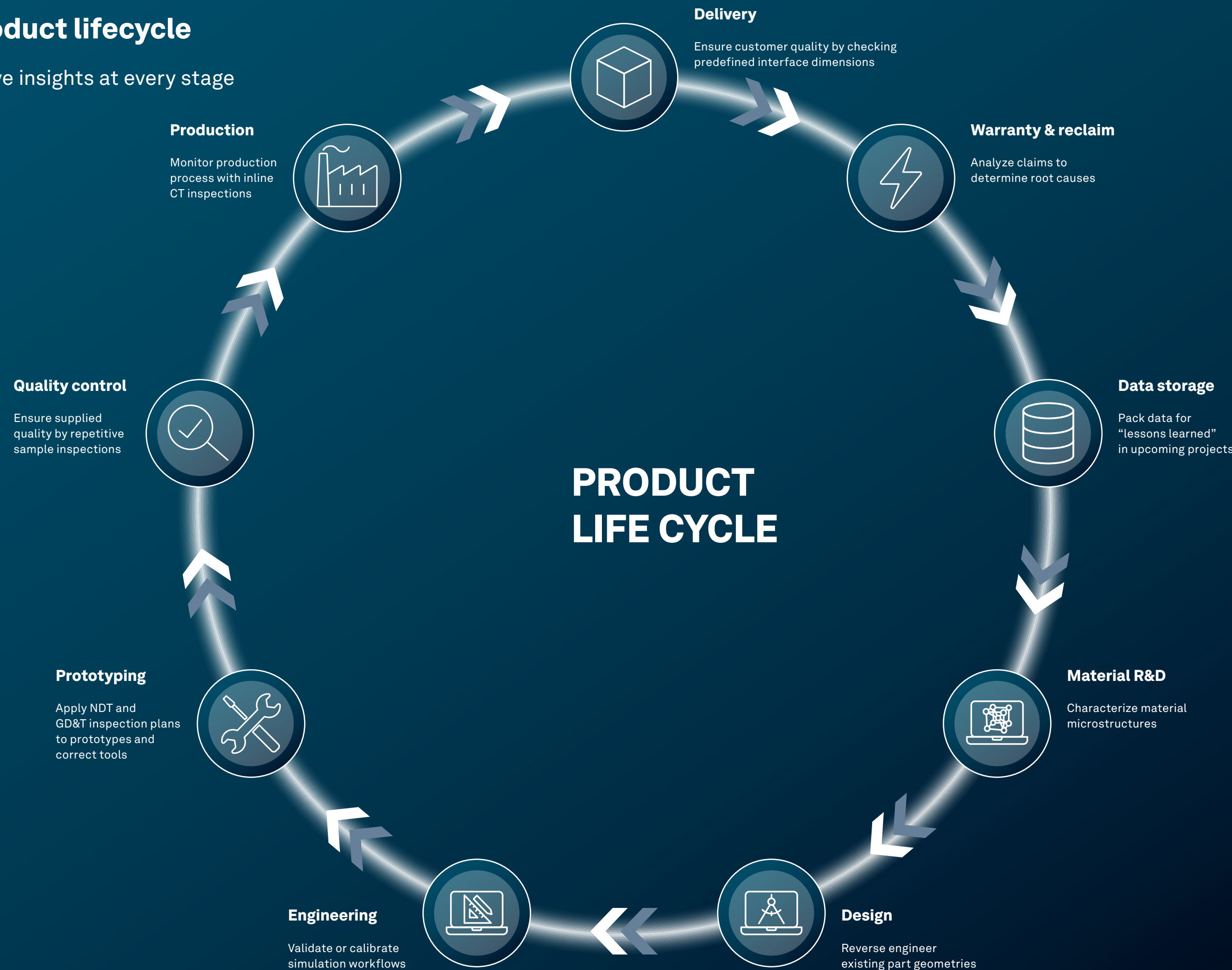
Yet to get measurements, find defects, create meshes, or perform simulations, you need advanced analysis and visualization software like our best-in-class VG product suite.

With its fully integrated CT reconstruction function, VG 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 VG software together with their hardware. In addition, we rely on a worldwide network of distributors to serve our customers around the globe.



CT in the product lifecycle

For comprehensive insights at every stage



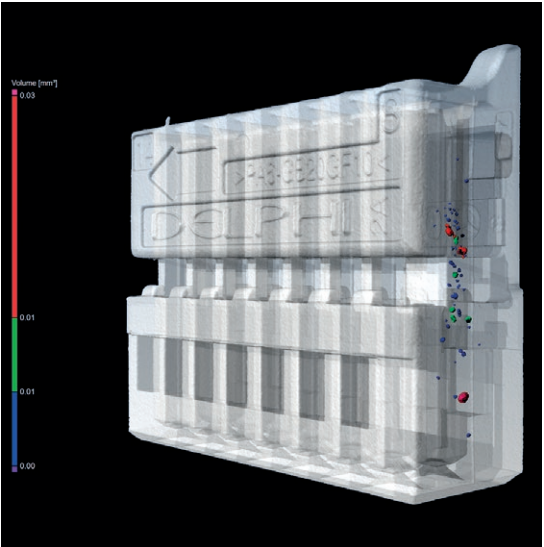
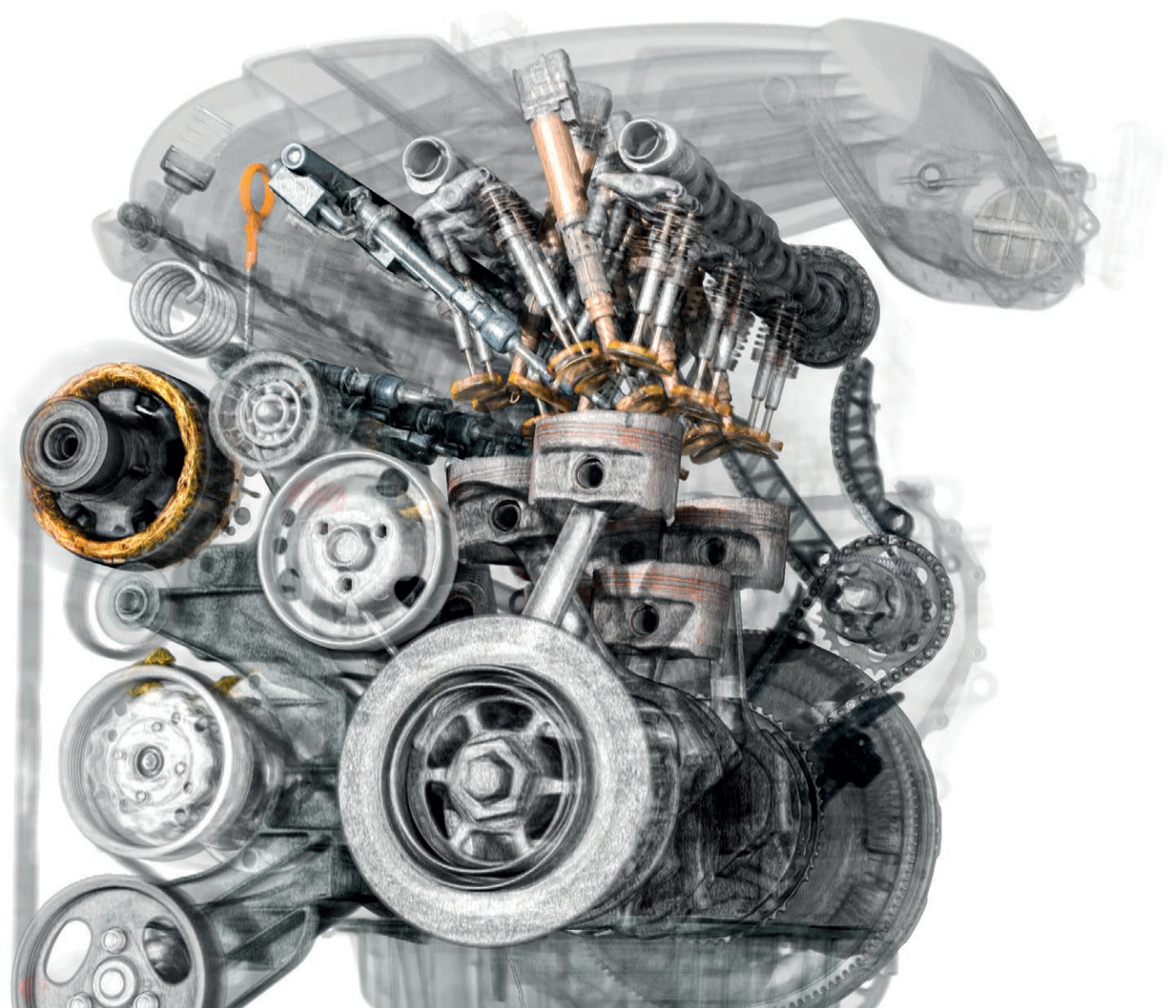
A more efficient look inside

Analyze faster and cost-effectively
with VG software

Like many of our customers, you too can save time and money by using industrial CT. This highly precise, non-destructive technology looks inside your products and finds defects that would otherwise remain hidden when using other inspection methods. However, industrial CT can only reveal its full potential when combined with the right software. VG software is your key to unlocking this potential. Customers use our software on objects small and large, simple and complex.

It works on parts made of metal, plastic, and composite materials — or all of them together.

Performing analysis tasks directly on voxel data not only opens possibilities that go way beyond conventional destructive or other non-destructive methods — it also has efficiency benefits.*



Inspection costs reduced by 50%

An automotive supplier used industrial CT in combination with VGSTUDIO MAX to measure its connectors and their 1,200 measurement features.

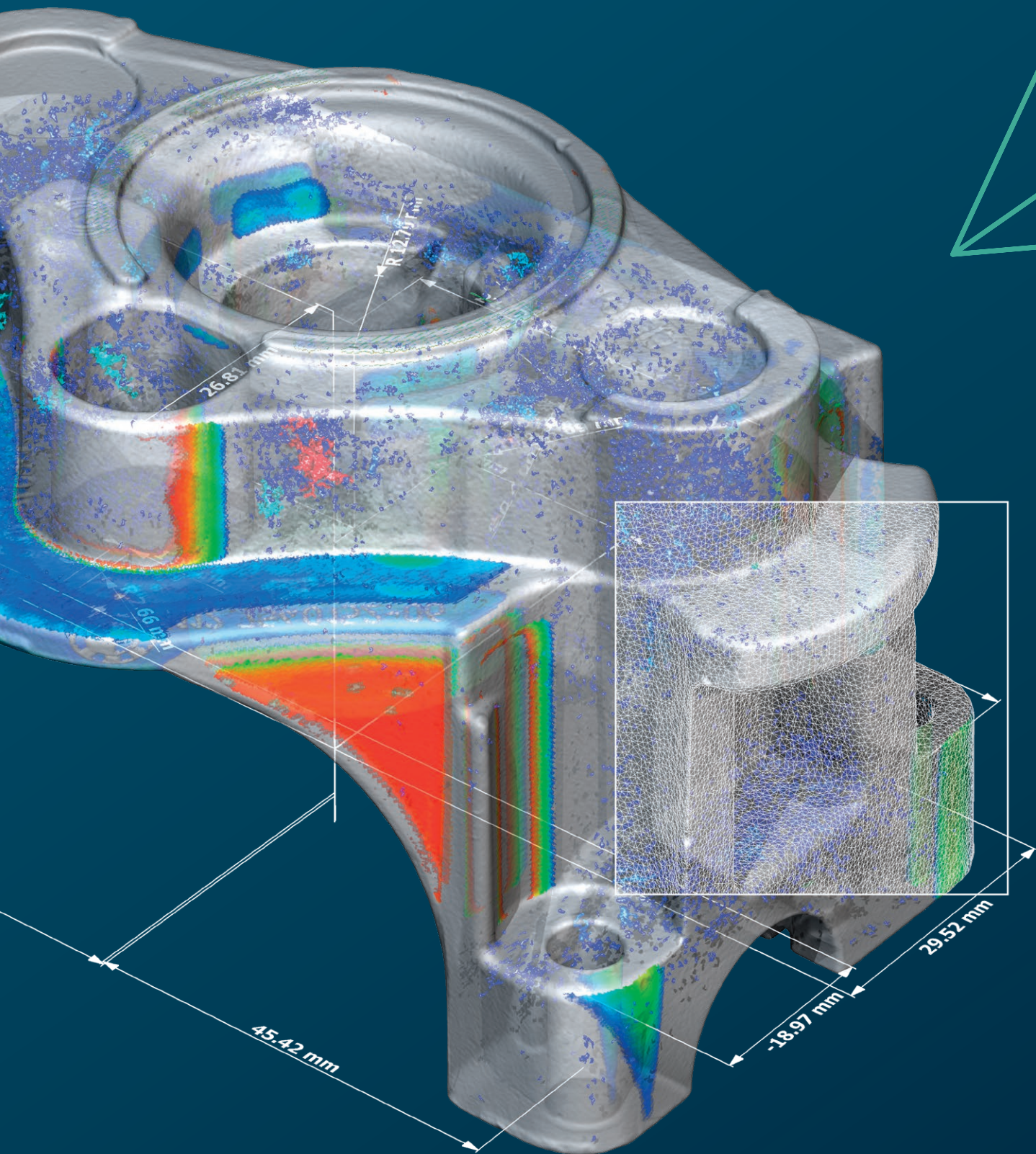
An Austrian automotive supplier reduced costs by around 50% after introducing industrial CT as a measurement tool. Measurements using conventional optical and tactile inspection methods took 450 man-hours for the initial acceptance alone and destroyed the part in the process. Industrial CT provided insight into virtually all features of the part without destroying it — and at lower costs. With the help of CT data and the macro and batch functionality of VGSTUDIO MAX, the same process only took 100 man-hours with only 80 more man-hours needed for final acceptance.

Inspection time decreased by 84%

An automotive supplier used industrial CT and VG software to inspect several hundred individual features on the connector.

The automotive supplier went from slice sectioning to using industrial CT-based metrology to inspect its plastic connectors — and thereby reduced the time needed for first article inspection from 75 to 12 man-hours while simultaneously improving measuring accuracy. This increase in speed was achieved in part by using the highly efficient measuring template functions of VG software to inspect several hundred individual features of each connector.

*The examples in this brochure are not meant to be representative. Actual efficiency gains are highly individual and vary from case to case.



Volume Graphics

Software for industrial CT

Overview

From design to serial production, our software enables you to keep the quality high by getting full insight into your products at every step of the production process — all over the world.

With the VG software suite, comprising VGSTUDIO MAX, VGSTUDIO, VGMETROLOGY, VGinLINE, and myVGL, you can perform all kinds of analyses and visualizations directly on industrial CT data.

Our customers in both industry and science know that our products give them a decisive advantage: the ability to gain reliable insights and make better products. It's time you join them.

Volume Graphics, a Hexagon company

A leader in comprehensive quality assurance since 1997

By choosing our software, you can rely on more than 25 years of experience in software development for non-destructive testing based on industrial CT. Today, a broad range of global customers across a wide range of industries (e.g., automotive, aerospace, and electronics) use our solutions for quality assurance in product development and production. For an ever-growing community of users around the world, VG is the software partner of choice.

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.*



Since 2020, Volume Graphics has been part of Hexagon. Hexagon is a global leader in sensors, software and autonomous solutions. Learn more about Hexagon (Nasdaq Stockholm: HEXA B) at hexagon.com and follow us [@HexagonAB](https://twitter.com/HexagonAB).

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

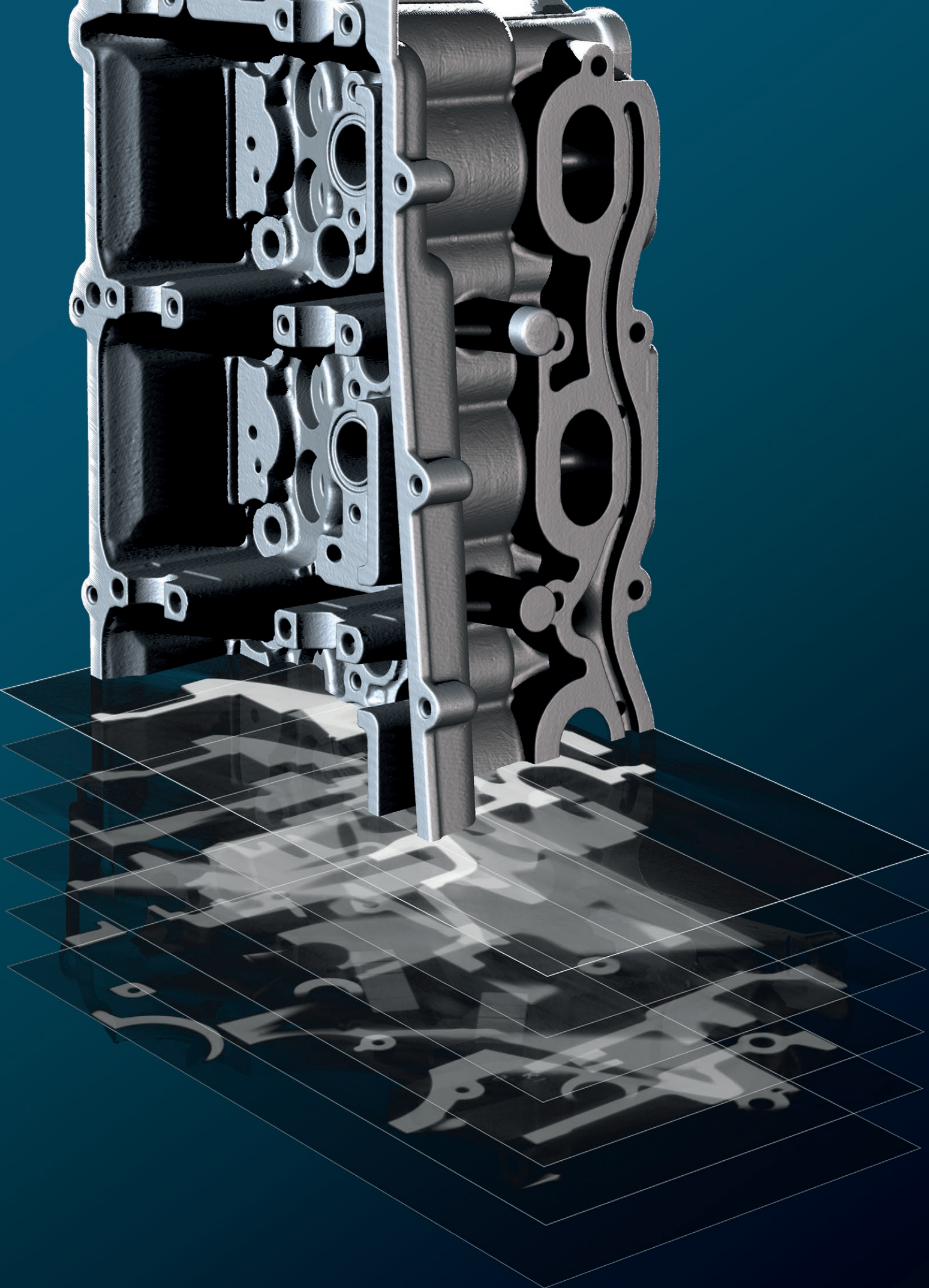
Benefits of VG software

A future-proof investment that provides efficient workflows to tackle your challenges

Your product quality faces numerous and challenging demands. Our software provides you with the reliable results you need to make the right decisions to meet those demands. Whether you are using the all-encompassing technology of CT or other 3D data formats such as point cloud, mesh, and CAD, VG software covers all your requirements related to metrology, defect detection and assessment, material properties, and simulations in a single software.

All of our analysis, simulation, and visualization tools fit perfectly into your digital workflow.

Future-proof	Efficient	Real solutions
<ul style="list-style-type: none">• Leading developer of CT analysis and visualization software• Comprehensive scope of functionalities for all current and future tasks of CT data analysis• Stepwise functional extensions based on a modular product concept• CT hardware-independent, working equally well with different CT systems from different manufacturers• Strong hardware partner and distributor ecosystem for worldwide availability of our products	<ul style="list-style-type: none">• Wide range of analyses for the exact task at hand• Easy automation of repetitive tasks incl. easy replication of analyses across periodic object structures• Fast handling of huge data sets & analyses• Seamless digital workflow from design and correction to inspection and production:<ul style="list-style-type: none">› Use one software for all analyses› Transfer inspection plans from the lab to production lines› Share data and results without format conversions	<ul style="list-style-type: none">• Instructive and insightful results that empower informed decisions• Validated accuracy of the results• Competent support pre- and after-sales with short response times• Worldwide training courses at VG Academy to get you up to speed on using VG software



CT reconstruction & data quality analysis

with VG software

Overview

The right algorithms for your scanner so you get the most out of your scans.

State-of-the-art CT-reconstruction algorithms and artifact reduction techniques to get the most out of your X-ray data.

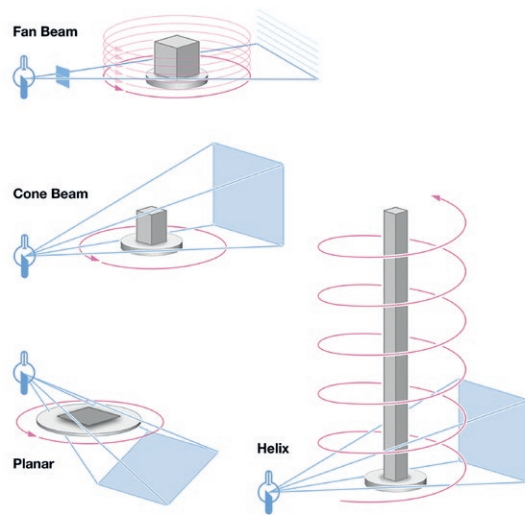
Monitor the health of your measuring device through standard-conforming data quality analyses.

CT reconstruction & data quality analysis features

Scan for more information:



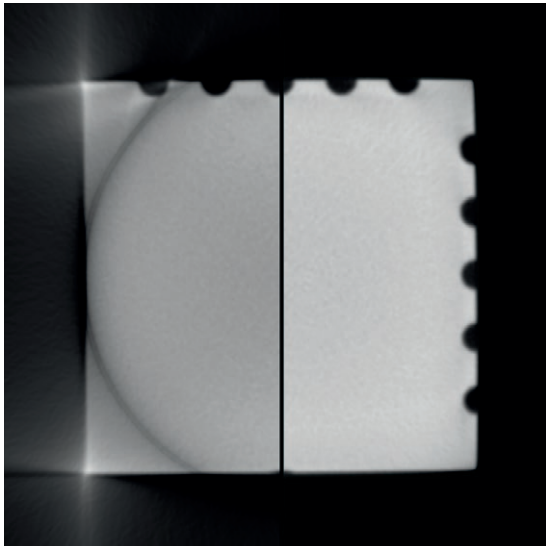
01



01 / Support of various CT system geometries

Calculate 3D volume data sets quickly and precisely from the images taken by a CT scanner. VG software offers reconstruction algorithms for cone beam, fan beam, parallel beam, planar (tilt cone beam CT, tilt and warp cone beam CT, advanced CT), and helical (spiral) CT scan geometries.

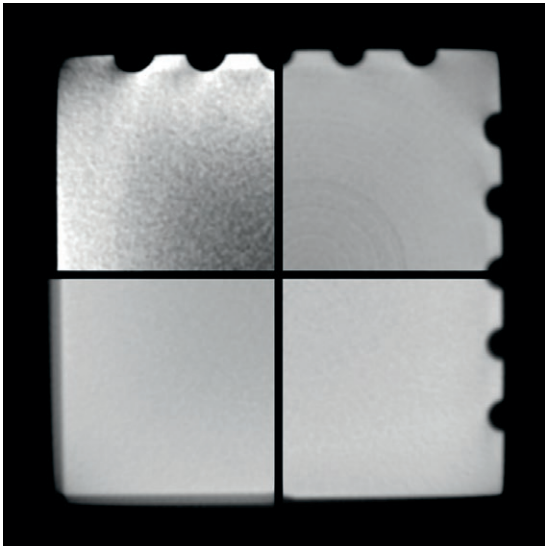
02



02 / Field-of-measurement extension/measuring circuit extension

Think even bigger. Measuring circuit extensions allow you to shift either the detector or the object and reconstruct large parts.

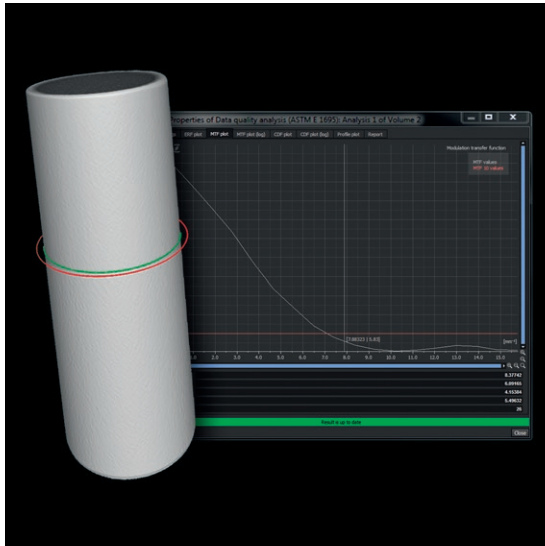
03



03 / Artifact corrections

Improve image quality using sophisticated corrections for beam hardening, noise and speckle, ring artifacts, misalignment, and angular drift.

04

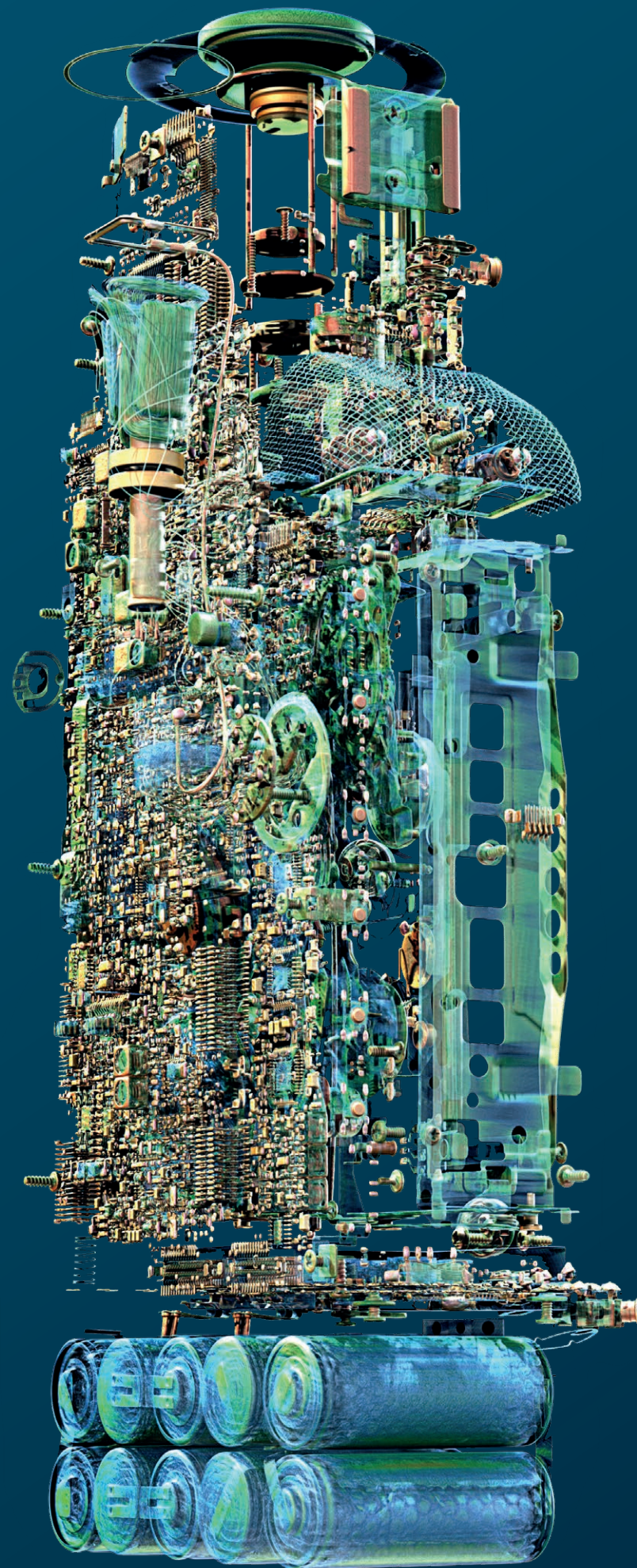


04 / Data quality analysis

Monitor the data quality of your CT scans over time by keeping track of the spatial resolution and gray value contrast resolution. This ensures a consistently high-quality basis for your analysis and measurement results. VG software supports data quality analysis according to ASTM E 1441 and ASTM E 1695

Benefits

- Independent of and compatible with all your CT hardware. Versatile 3D visualization of very large, multiple data sets – whether voxel, point cloud, mesh or CAD – in one scene.
- Existing CT hardware can be upgraded with software-based artifact corrections and field-of-view extension.
- Monitoring of CT scan quality to ensure accurate inspection results.



Visualization & animation

with VG software

Overview

Transform your data sets into stunning visualizations and animations.

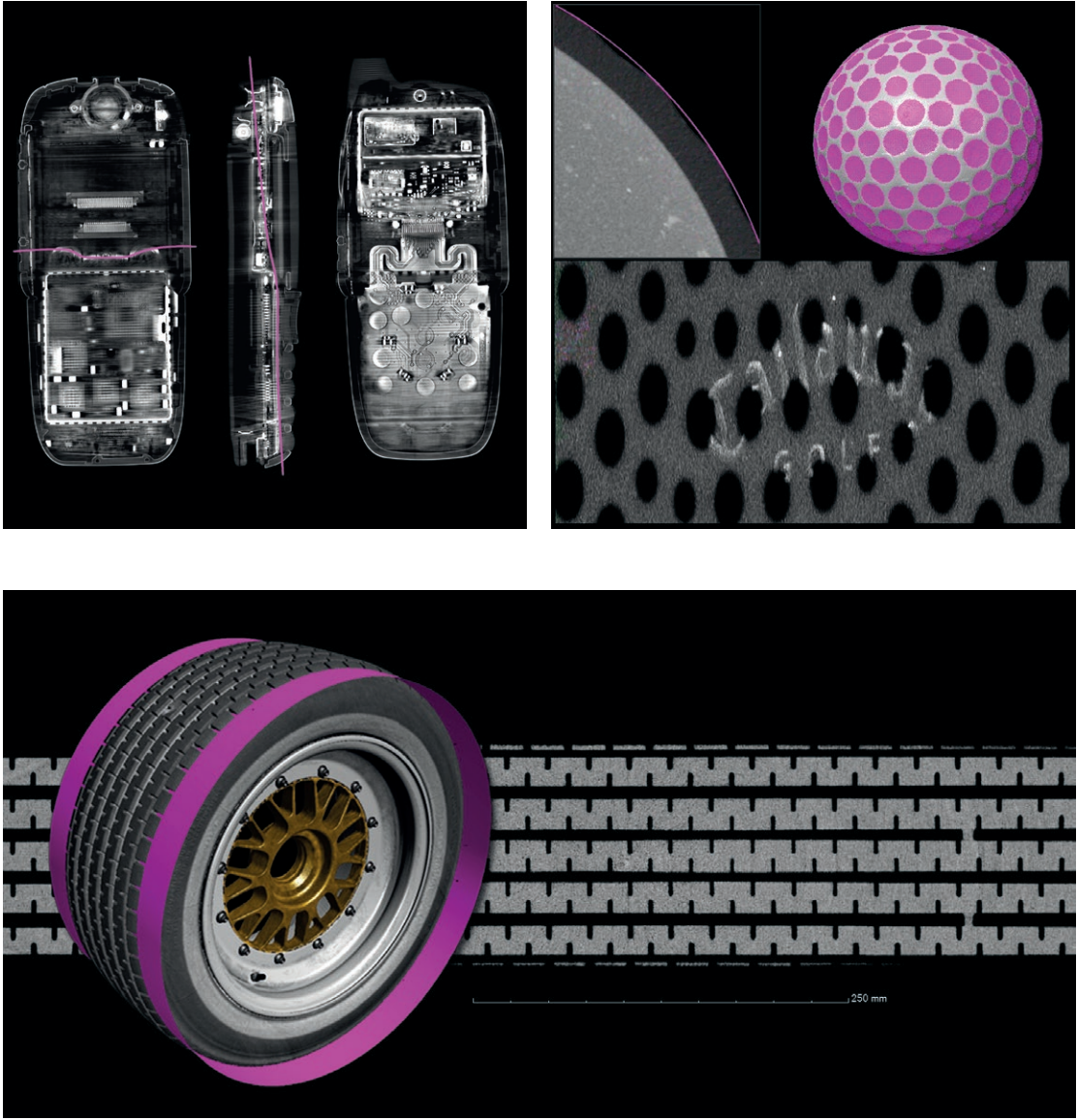
VG software lets you shine when presenting your findings to peers, decision-makers, and the public. Impress in 3D and 2D, with exploded views and animations.

Visualization & animation features

Scan for more
information:

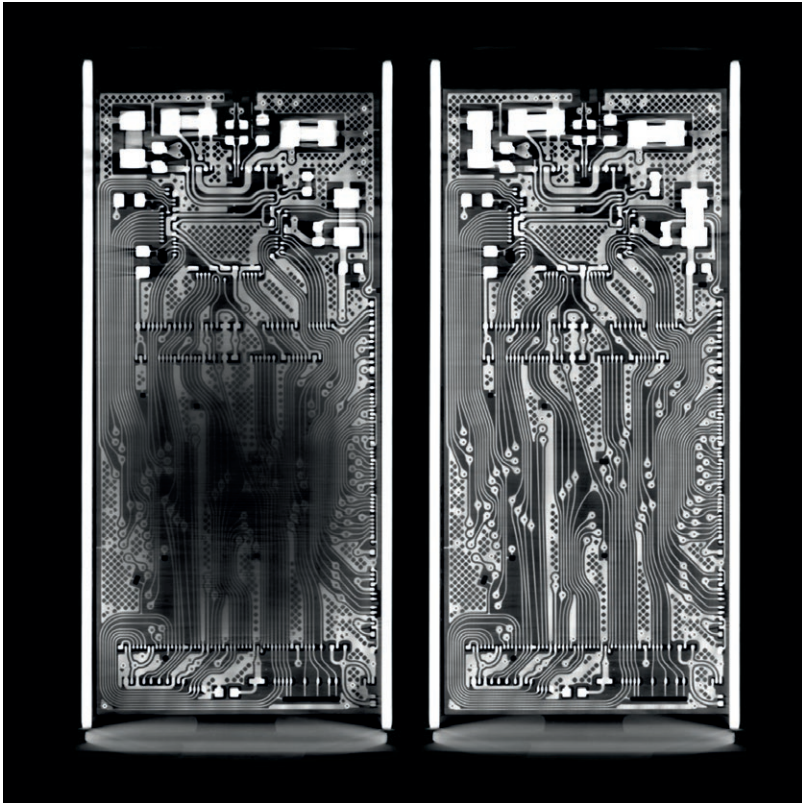


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01 / 2D Visualization

Display aspects of your CT scan in informative 2D visualizations. Our software allows you to view 2D slices in arbitrary orientations and to rotate them around a customizable axis. Create 2D views of combined consecutive slices, unrolled objects, or leveled freeform surfaces.



Visualization & animation features

Scan for more information:



02



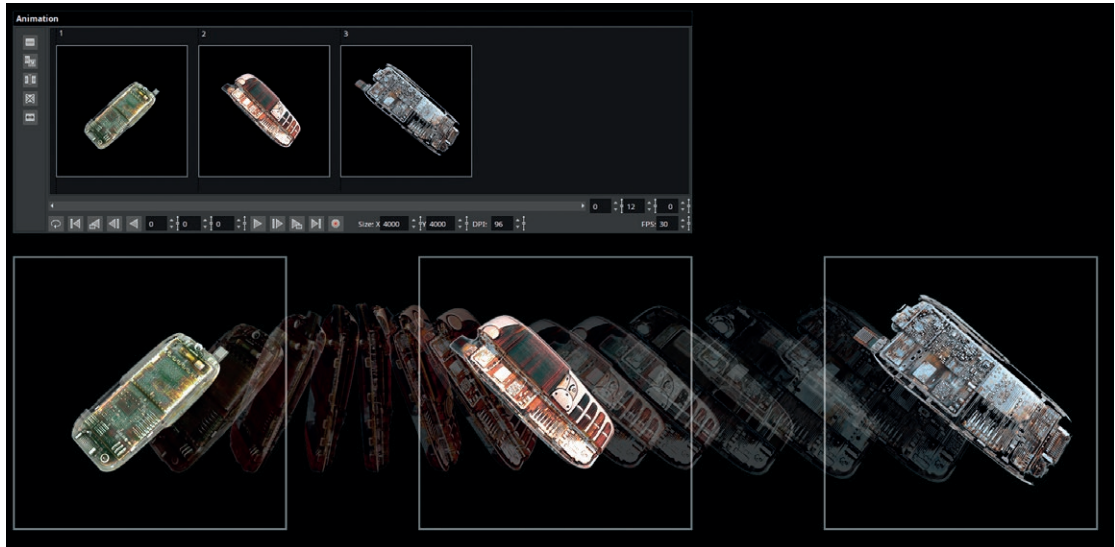
02 / 3D Visualization

Render any number of data sets from different sources such as CT, optical scanners, or CAD models in one scene. Only your workstation's memory is the limit. Our software supports voxel, point cloud, mesh (including textured meshes), and CAD data.

Photorealistic illumination is applied to all objects, both volume and mesh data. Flexibly choose material appearance, light sources, and transparency as well as a range of clipping features for a glimpse into the object.

Show connected components in an exploded view. With the Object Exploder, this kind of industry-standard presentation is just a few clicks away.

03



03 / Animations

Create impressive animations of your volume data quickly and easily with Simple Keyframer. Simply define a few keyframes and let the software do the rest — like camera movement and parameter blending in between. Or use Classic Keyframer to have full control over camera trajectories and timing.

To help viewers find orientation in your animation, indicate the exact position of the respective 2D slice in the 3D view — side-by-side or picture-in-picture.

Benefits

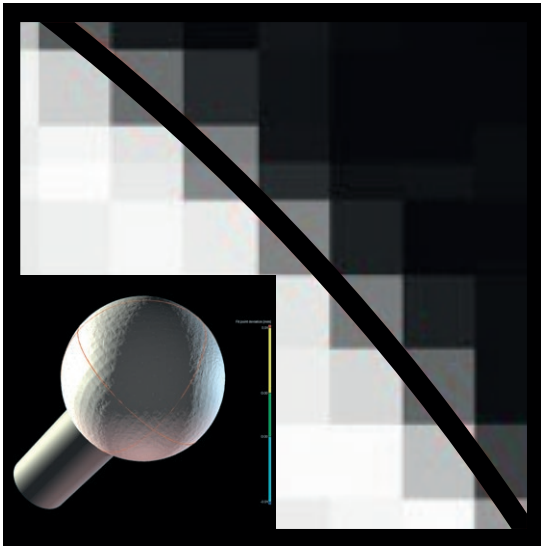
- Versatile 3D visualization of multiple large data sets (voxel, point cloud, mesh, or CAD) in one scene
- Insightful views into visualized objects through exploded views, unrolled objects, transparency settings, and a range of clipping features
- Stunning photorealistic renderings enabled by real-time ray tracing, material appearance settings, and support of textured meshes

Dimensional metrology features

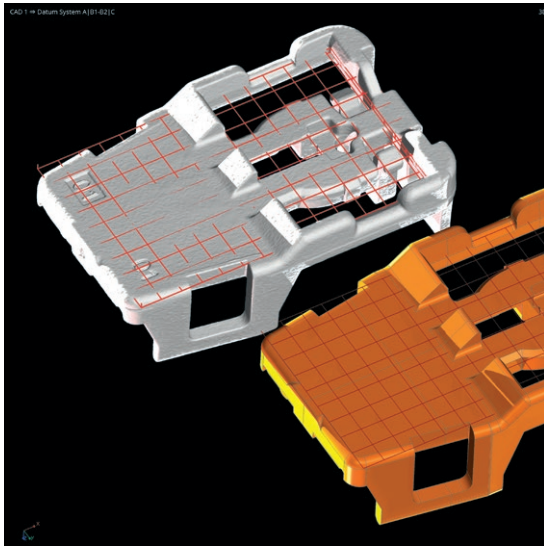
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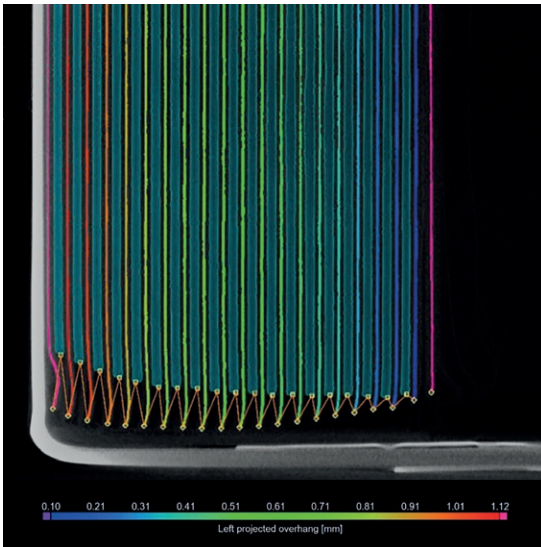
01 / Surface determination

The VG subvoxel-accurate, locally adaptive surface determination ensures minimum measurement uncertainty. Contrary to a generic iso 50 surface determination based on a global gray value threshold, it considers the local gray value profiles around the surface, which makes it robust against common artifacts in the gray values. The locally adaptive surface determination works for both single-material and multi-material CT scans.

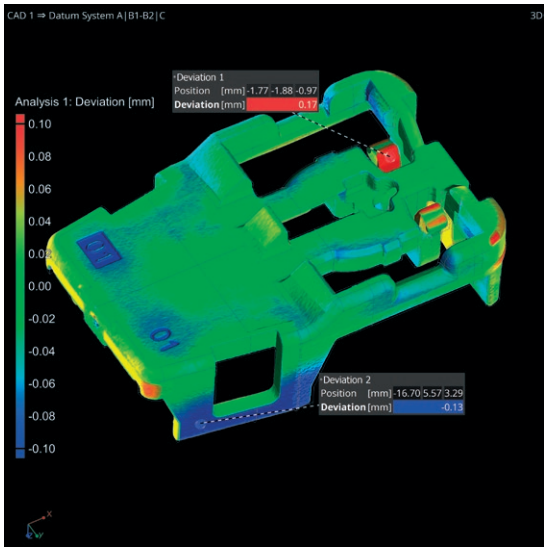
02 / Alignments

VG software supports various alignment techniques such as 3-2-1, RPS, and best fit, which allow you to solve even the most complex alignment tasks based on geometry elements, points, and regions — independently or in combination.

03



04



03 / Battery anode overhang analysis

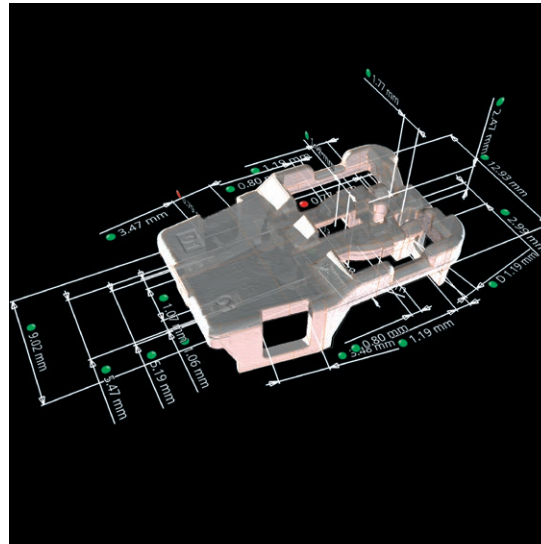
Our battery inspection feature allows you to measure and tolerance 2D anode overhang and more, such as shape-following lengths, electrode counts, and the curvature of the overhang. In addition, you can visualize the desired property in various ways.

04 / Nominal/actual comparison

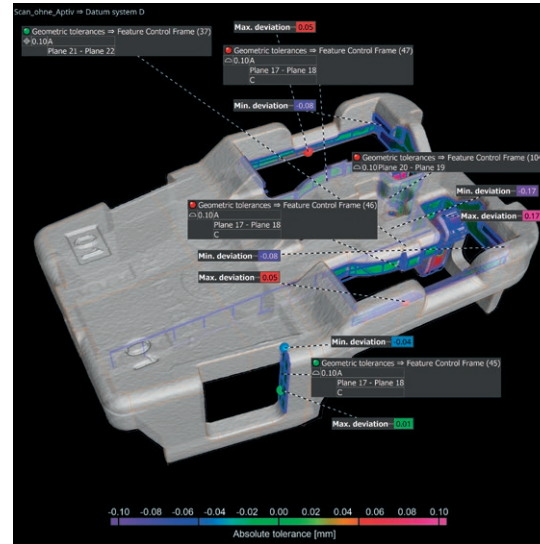
Compare your scanned object with its corresponding CAD data set. The nominal/actual comparison gives you color-coded results of deviations and local annotations.

Dimensional metrology features

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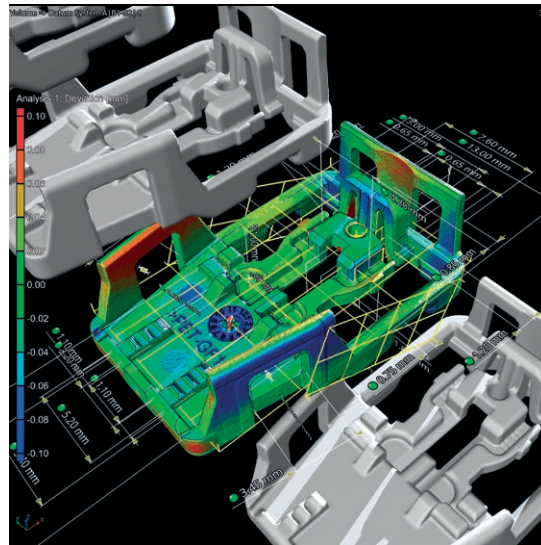
05 / Dimensional measurements

You can measure 2D and 3D dimensions either with standardized tolerance tables to automatically set tolerances or individual tolerance tables to set name, dimension, and tolerance automatically by balloon number.

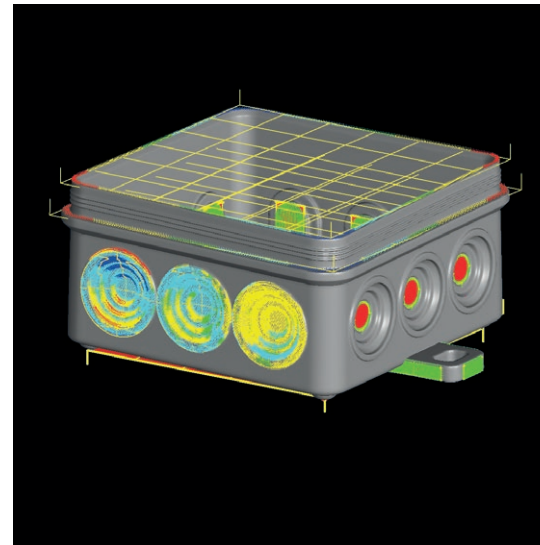
06 / GD&T

Our software supports all 17 GD&T callouts, such as line and surface profile as well as position with maximum material requirement (MMR). Local coordinate and datum systems enable you to perform sophisticated geometry analyses and simultaneous visualizations of multiple GD&T callouts.

07



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07 / PMI import and automation

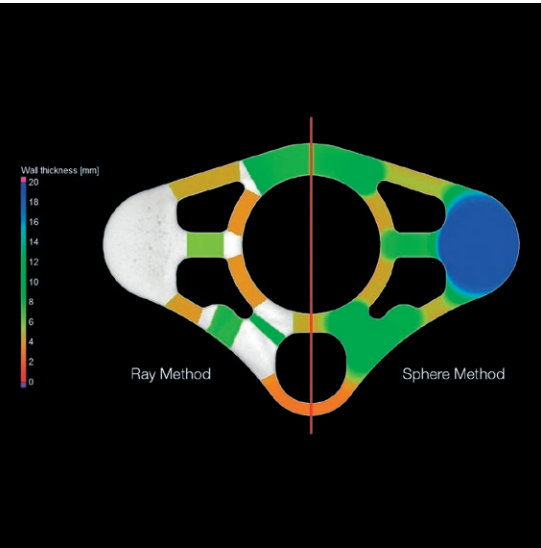
Our software is compatible with all neutral CAD data types and most vendor-specific formats, including Product and Manufacturing Information (PMI), which provides additional part information, e.g., dimensioning, GD&T, layers, annotations, and captions. Processes can be automated using macros, batch processing, and templates.

08 / Adaptive measurement templates

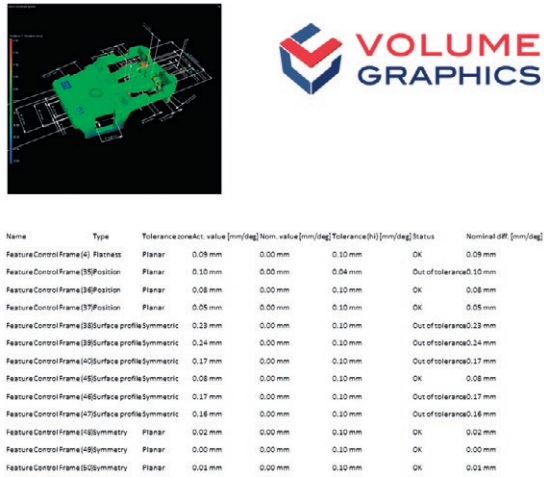
With adaptive measurement templates, a nominal measurement plan can be applied to even heavily deformed parts. Apply any measurement template from a CAD file including PMI or an existing measurement template created on CAD or scan data. The software makes sure the measurement points are placed at the optimal positions, perfectly following the distorted shape. This enables you to use one template for the whole part life cycle.

Dimensional metrology features

09



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09 / Wall thickness

Perform volumetric analyses of a part's thickness quickly and automatically — either using the ray method for parts with simple shapes or the sphere method for more organic shapes, including complex 3D-printed parts. Color-coded results help you localize areas with an insufficient or excessive wall thickness or a gap width within the voxel, point cloud, mesh, or CAD data set.

10 / Reporting

Get fully customizable reports including histograms, data tables, and insightful graphics. Reporting via Excel, PDF, and Q-DAS enables integration in downstream processes. Free viewer applications allow you to share information.

Accurate

- Unique locally adaptive and subvoxel-accurate surface determination
- Surface representation directly on the CT data — no loss of accuracy and traceability from converting to a surface mesh

Efficient

- Import PMI measurement plans directly from CAD models
- Automate the replication of measurement plans across periodic structures
- Automate the implementation of measurement plans and reporting both in the lab and in production
- Use a compact file format for worldwide data sharing

Universal

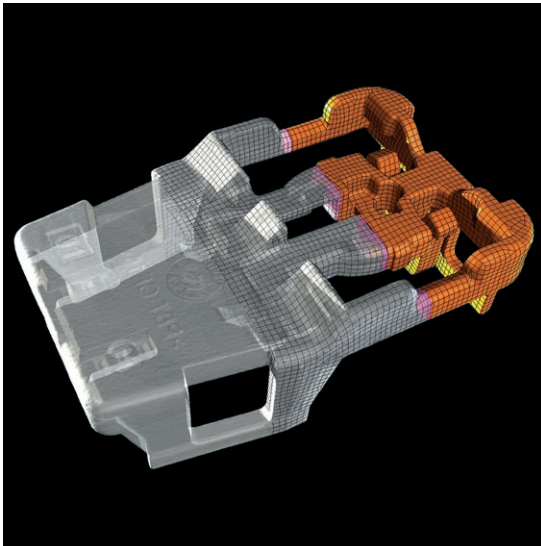
- Hardware independent — can be combined with almost any CT or optical scanner
- Leading software for all industrial CT analyses, including metrology, indication analyses, and material structure analyses

Reverse engineering features

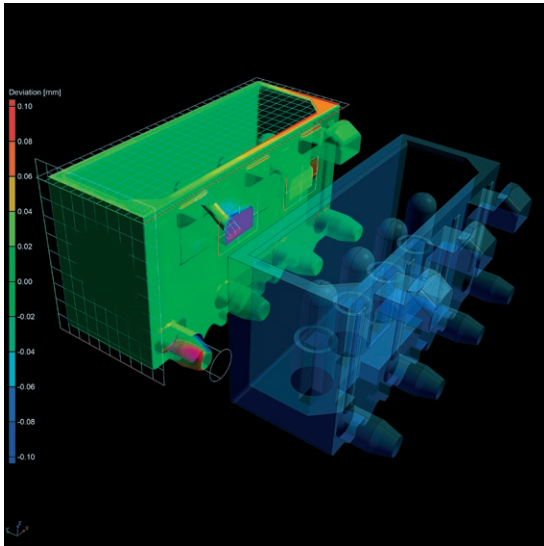
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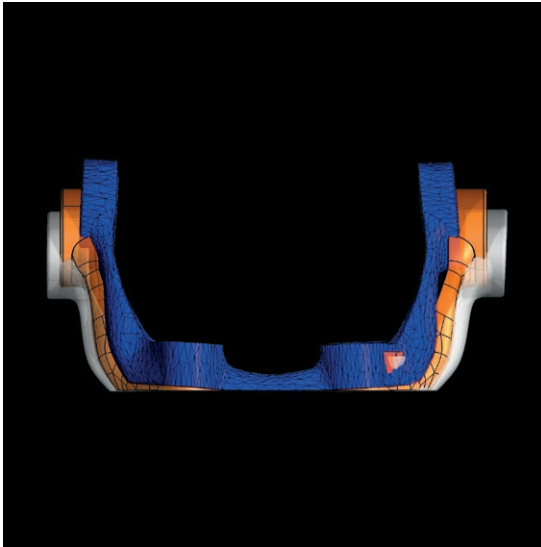
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01 / Reverse engineering

Convert CT scans into CAD models you can use in your CAD systems with the reverse engineering functions in VG software. The software generates an autosurface on a scan, i.e., a pattern of 4-sided patches that follow the edges and main features of the model, which can be exported as a STEP file to any CAD system.

02 / Manufacturing geometry correction

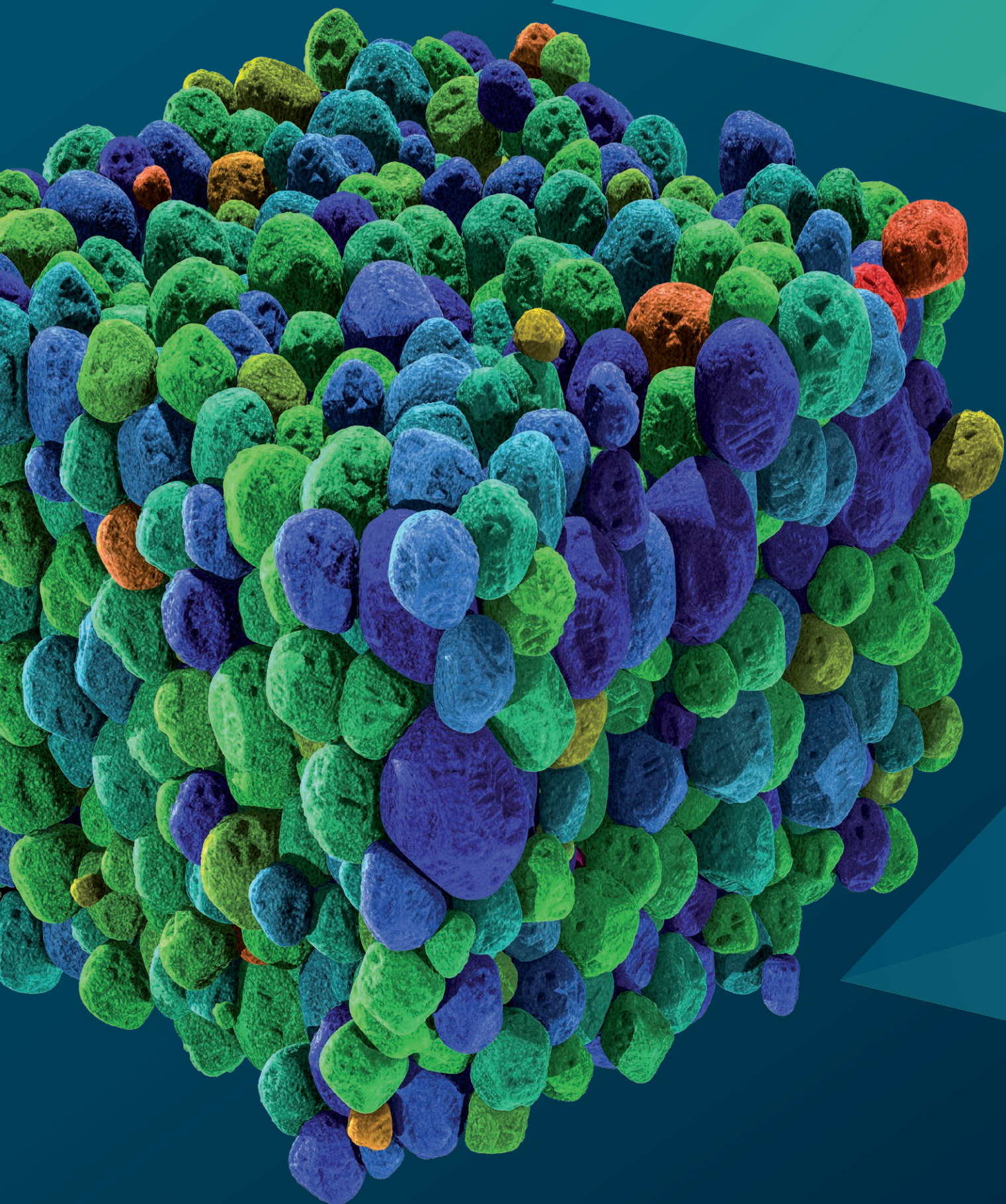
Optimize your tools or 3D printing geometries with the functions for manufacturing geometry correction. The software uses scans of your sample part to calculate suggestions for necessary changes to tools and molds to minimize iterations.

03 / 3D printing mesh compensation

Create a surface mesh that compensates the difference between the actual object and the reference object — directly from the CT scan using mesh compensation. The software compensates the mesh sent to a 3D printer to eliminate deviations in the actual geometry caused by distortions, such as warpage. Choose arbitrary, defined, or gridded anchor points for the compensation. Use ROIs to define areas of interest and scale the deformation to your needs.

Benefits

- Accurate representation of scans and compensated tool geometries
- No need to learn a CAD system
- Works on point clouds, meshes, and CT scans



Material analysis

with VG software

Overview

Reveal what's below the surface of your scanned parts. With VG software, you can comprehensively investigate and quantify the material properties of your parts using non-destructive testing (NDT).

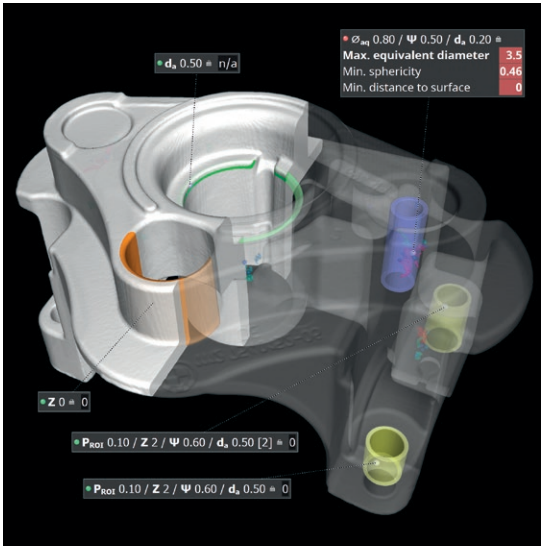
Analyze designed material properties as well as discontinuities and visualize them — from research and development to the production stages.

Material analysis features

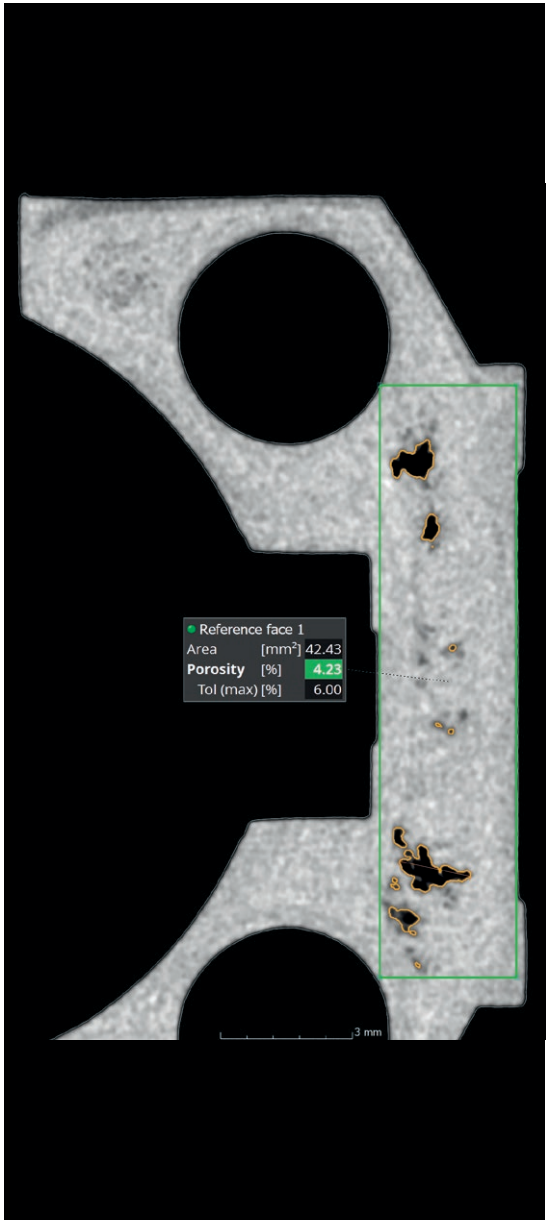
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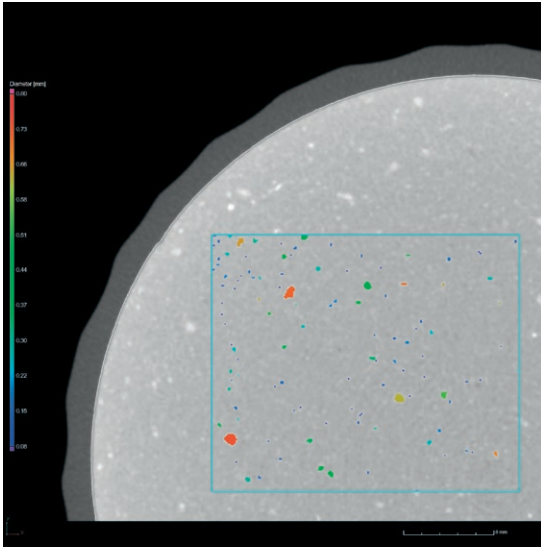
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01 / 3D Porosity analysis

Recognize and characterize porosity in three dimensions. Detailed parameters on size, shape, and number of discontinuities allow you to differentiate between gas pores and shrinkage deficits. The results can be combined and analyzed with the existing component wall thickness or a virtual machining of the component.

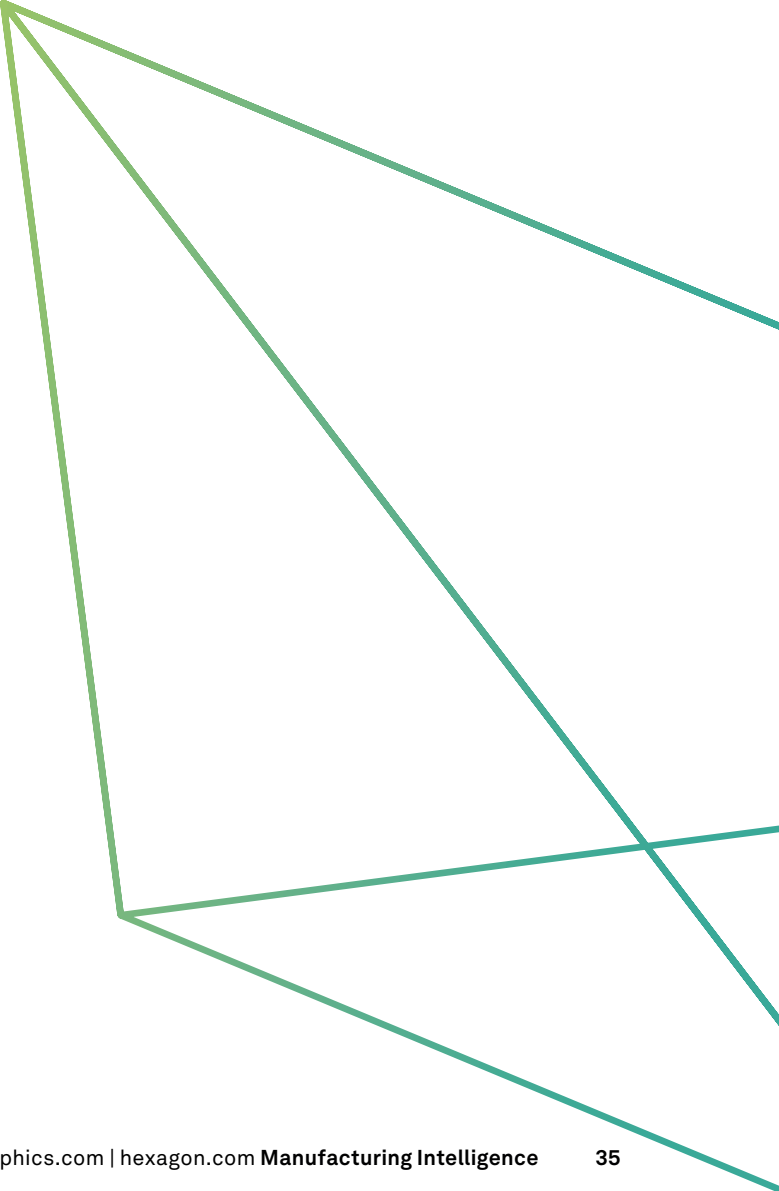
Inspect cast parts for porosity according to the Reference Sheet P 203 of the Federation of German Foundry Industry (BDG). Intuitive input functions make it easy to define porosity specifications based on the porosity key according to BDG P 203. By integrating important BDG P 203 specifications for porosity analysis as well as for the definition of three-dimensional characteristics of internal volume deficits, the software offers a fast, reliable, and comprehensive porosity analysis and evaluation of CT volume data.

02 / 2D Porosity analysis

Perform porosity analyses in accordance with supplier specifications or BDG guidelines, such as BDG P 202. In accordance with the BDG guideline P 202 used in the automotive industry, VG software can be used to determine the pore loss areas automatically and non-destructively in 2D CT cross-sectional images. The results can be combined with 3D CT analyses to investigate more complex technical issues.

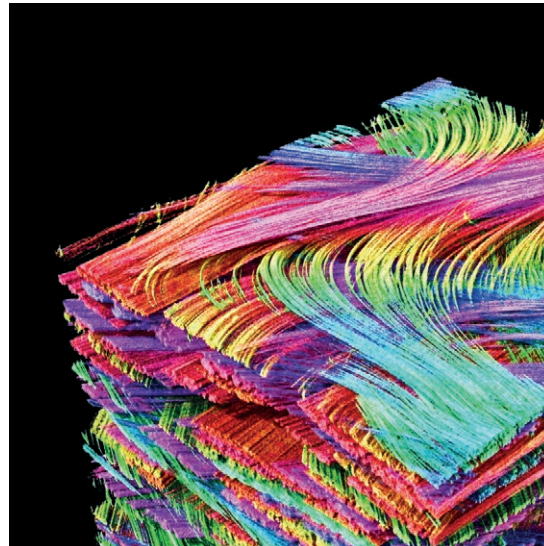
03 / Inclusion analysis

Detect particles within your part. With our software, you can detect unwanted contamination, for example, caused by machine wear, and explore the intended accumulation of added functional particles, such as metal flakes inside an insulator.

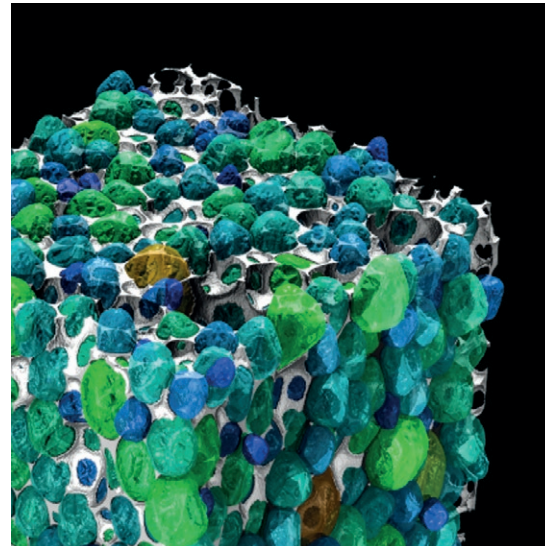


Material analysis features

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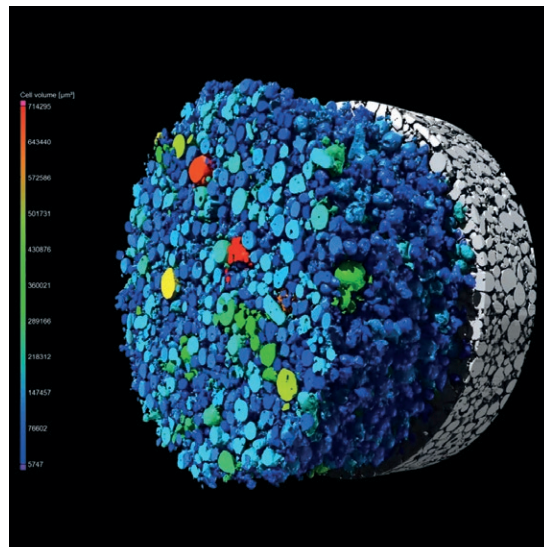
04 / Fiber composite analysis

Calculate and visualize local and global fiber orientations and fiber volume fractions in composite materials. Calculate local and global fiber statistics in the form of fiber orientation tensors or histograms as well as porosity in the matrix material. Principal orientations of woven fabrics or lay-up materials can be determined. Fiber and matrix properties can be mapped to volume meshes and exported for use in your simulation software.

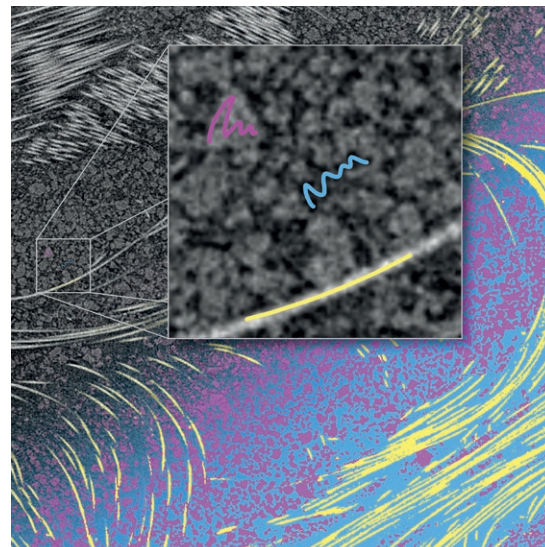
05 / Foam analysis

Determine cell structures in porous foams. With VG software, you can subdivide connected cells to individually quantify cell sizes and shapes. Strut thicknesses can be visualized locally and aggregated to global statistics, such as through histograms.

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06 / Powder analysis

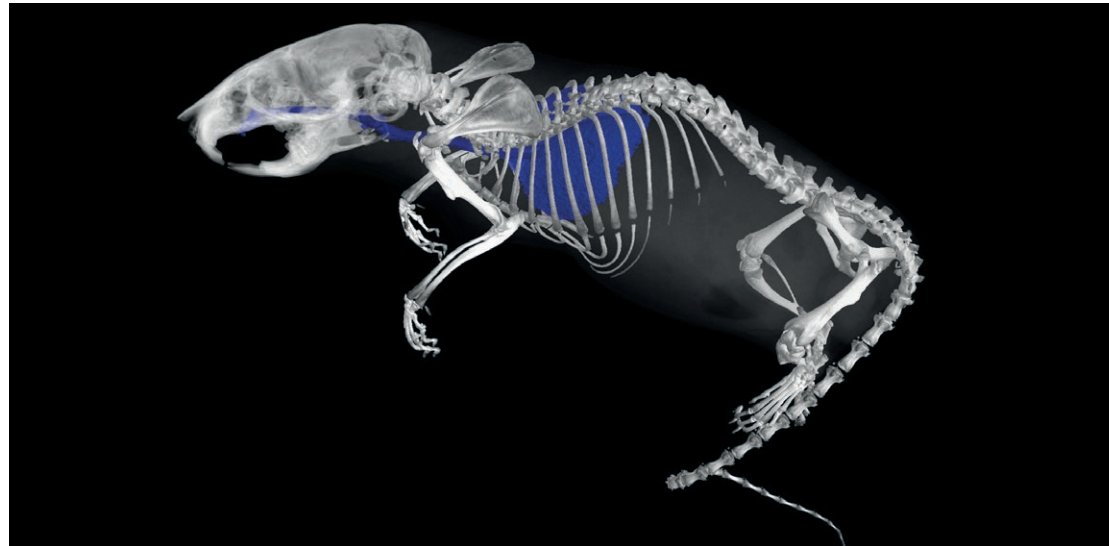
Determine grain structures in powders that are used for applications such as additive manufacturing. Use our software to separate particles to quantify features like volume, surface, and compactness for each particle individually, generate global statistics, and reveal directional dependencies that may result from the deposition of larger particles.

07 / Paint & Segment

This feature uses machine learning technology to optimize and speed up segmentation. Just “paint” the structures you want to segment in small regions and let “Paint & Segment” do the rest. Immediate visual feedback lets you gauge the quality of the current segmentation and quickly adjust if necessary.

Material analysis features

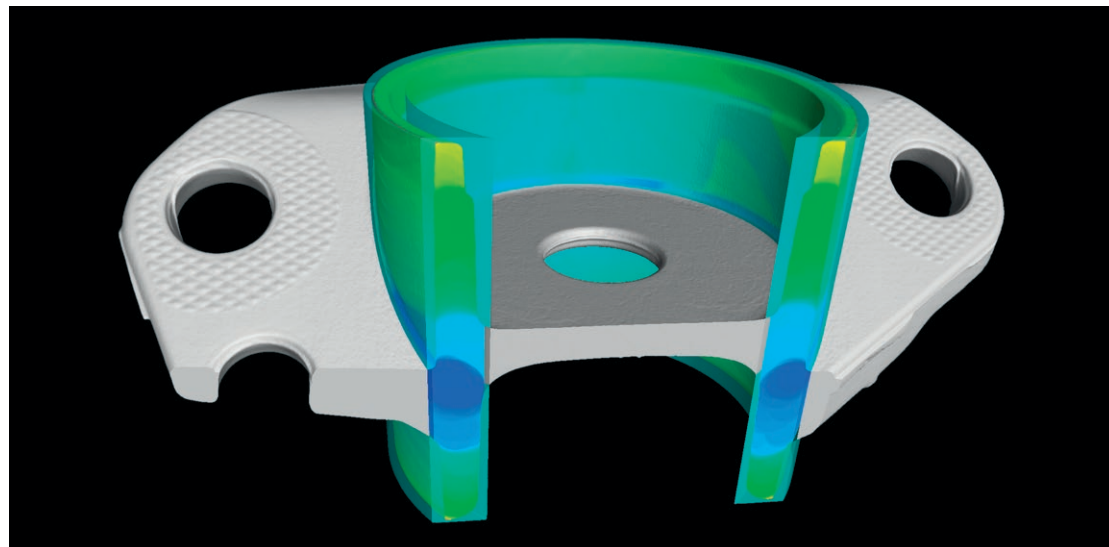
08



08 / Gray-value-based segmentation

Create regions of interest for segmenting different materials, which can be used in a wide range of applications — for example, you can create visualizations or perform further analyses based on a global selection of a gray value range of interest, manually selected regions constrained to specific gray value intervals, or the dynamic flooding of manually placed seed points until specified gray value limits are reached. Typical use cases include organic shapes in biological or geological samples, or organic shapes within engineered components like fluid channels.

09

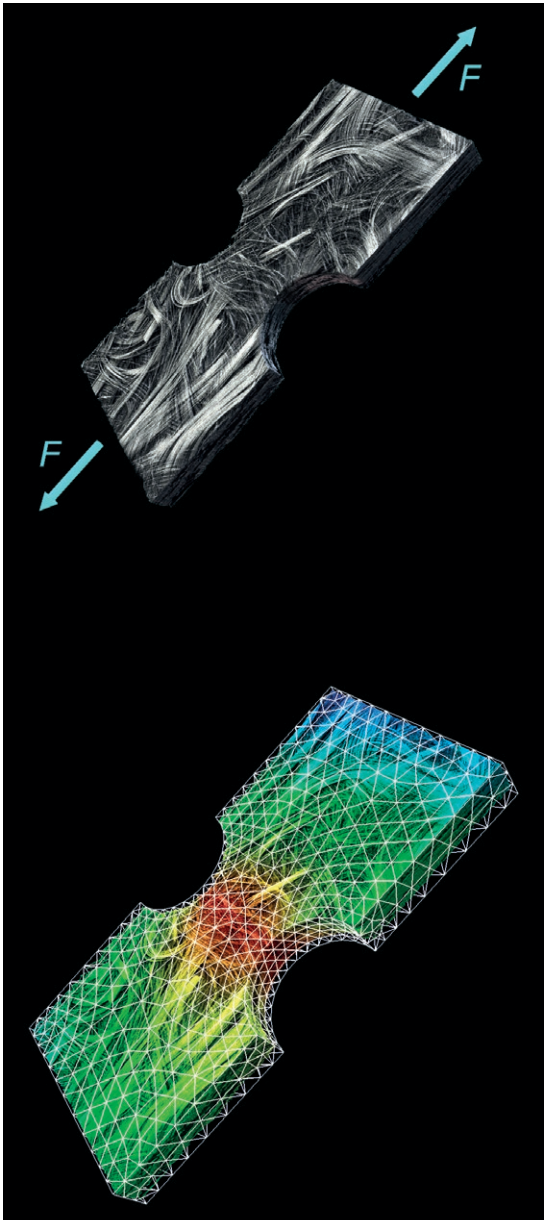


09 / Shape-based segmentation

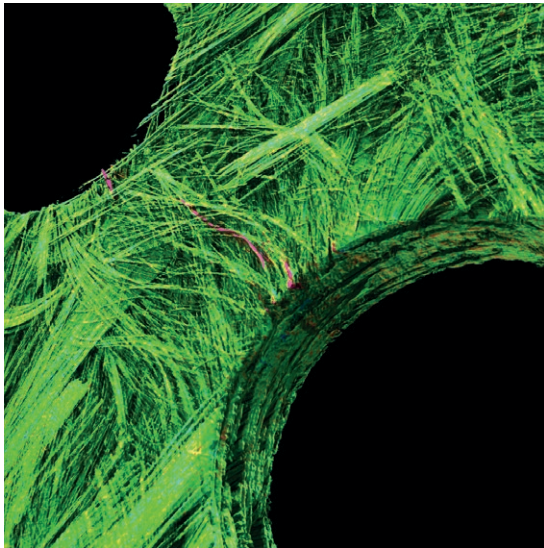
Create regions of interest with clearly defined shapes for visualization, segmentation, or further analysis from manually defined region outlines, automatically determined surfaces, or geometry elements fitted to surfaces combined with subsequent Boolean operations such as addition, subtraction, or intersection. Typical use cases include parts of engineered components or assemblies.

Material analysis features

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11



09 / Digital volume correlation

Quantify displacements between an initial and a deformed volume simply and intuitively. With our software, you can calculate the movement of each voxel from one volume to another for the analysis of in-situ tests or part deformation based on real-world component load. The software measures local displacement and strain tensors, visualizes deformations and movements via displacement arrows or lines, and maps results onto FE meshes to validate your simulations.

10 / Crack detection

Identify cracks in your parts. With semi-automatic crack segmentation, you can quantify cracks in single scans. By using multiple scans, you can compare these data sets and detect indications that can't be seen with the naked eye. Indications can be characterized, for example, by their surface. The measurement of the remaining wall thickness provides valuable input for your material characterization.

Proven

- Detection of indications proven in industrial practice
- Reliable determination of material properties like fiber orientations, even on low-quality data
- Validated accuracy of results

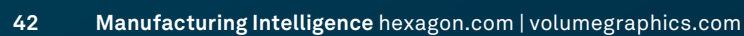
Instructive

- Instructive results for the non-destructive testing of components
- Comprehensive characterization of complex materials such as fiber compounds, foams, and lattice structures
- Mapping of material parameters onto finite element meshes for simulation

Efficient

- Intuitive analyses that don't require programming
- Easy automation of repetitive tasks
- Fully automated workflows from data analysis to reporting and data export

Overview

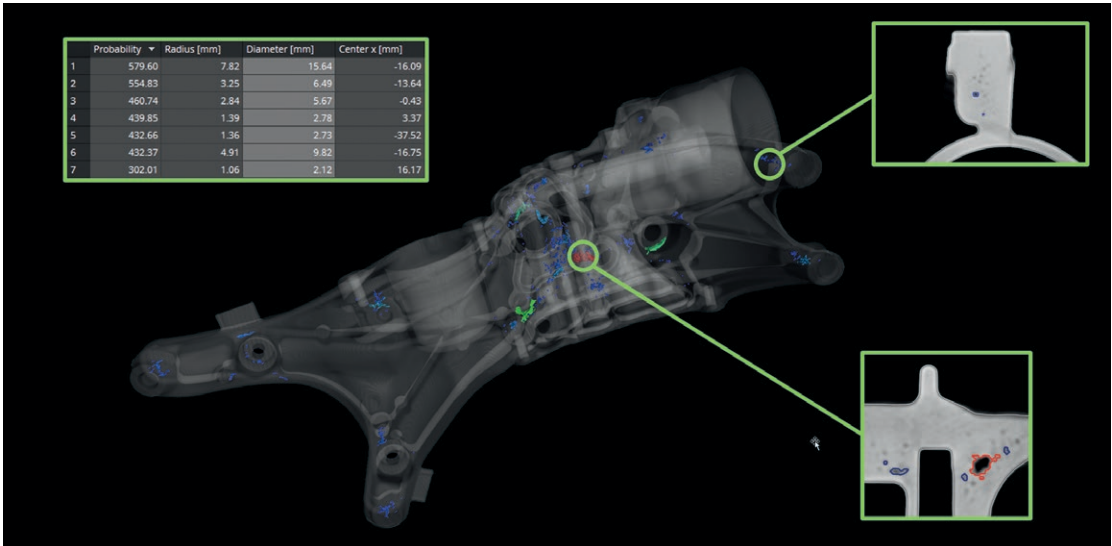
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Reporting features

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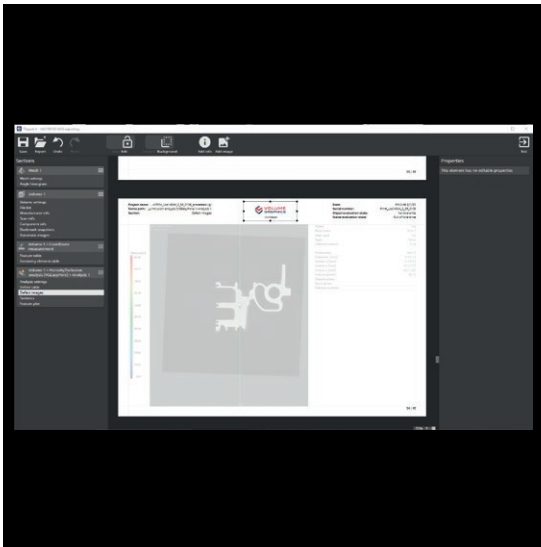
01



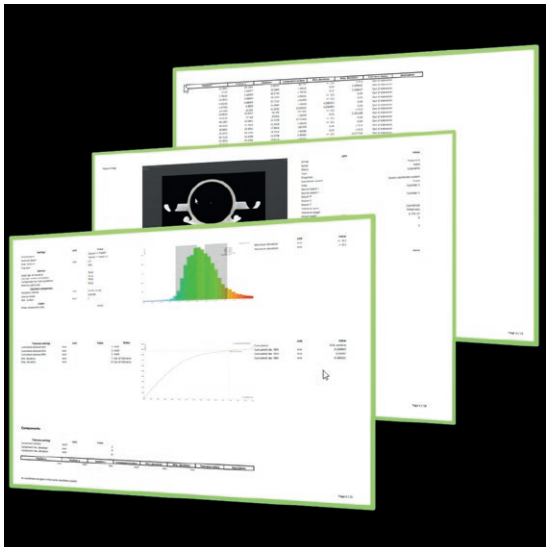
01 / Defining reportable content

Create reports based on the wealth of gray value and surface-based analyses and coordinate measurement features in VG software. You can generate additional content by defining rules that automatically create images or interactive markers according to certain result features, like tolerance states or indication sizes, and add arbitrary views to your reports using the advanced visualization capabilities of the software.

02



03



02 / Integrated reporting

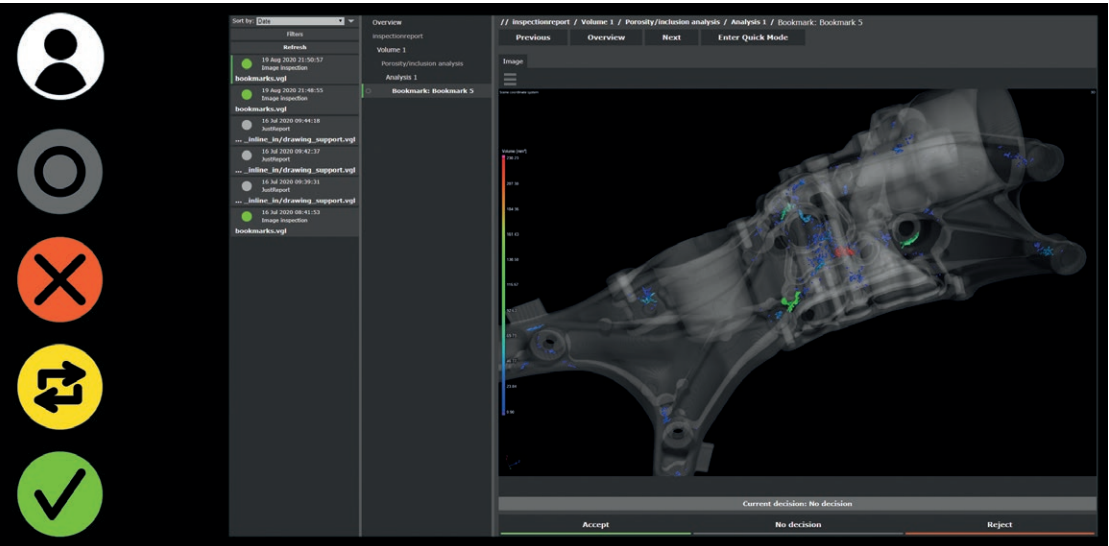
Generate audience-appropriate reports that focus on numerical results, images, or combinations of the two. Our software allows you to configure your report pages to include results and related content, part and project information, and even your company's logo. You can store reports as self-contained PDF or HTML documents that can be easily archived or shared or use viewer applications for an interactive view of the report and the full inspection project.

03 / Reporting via Excel

Create fully customizable reports with our add-in for Microsoft Excel. You can adjust layout templates to display results according to your specific needs, or even derive and display additional data from the reported content using powerful Excel formulas. Share adapted templates with colleagues or use multiple ones to generate personalized reports for individual customers.

Reporting features

04



04 / Review in VGinLINE APPROVER 05 / Q-DAS and raw data export

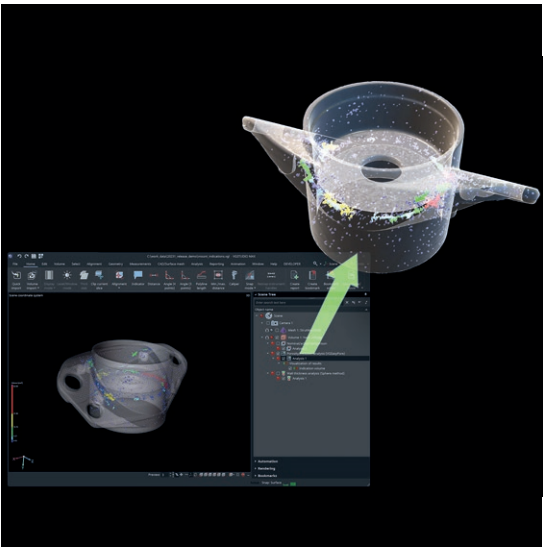
VGinLINE APPROVER is a web application that can display numerical or image results of stored inspections, show result positions on interactive 3D models of your part, and plot comparable results across different inspections. Enter comments or pass/fail decisions that can be exported in an interface format for use in other applications and are traced to individual password-protected user accounts.

Export complete coordinate measurement results or analysis data in the industry standard Q-DAS ASCII data transfer format or as CSV files. By supporting the Q-DAS format for data interchange, VG software allows you to include CT result data in your existing processes for statistical process control and production monitoring. With the open CSV-based report format, you can export results, metadata, and manual reviews to third-party software.

05



06

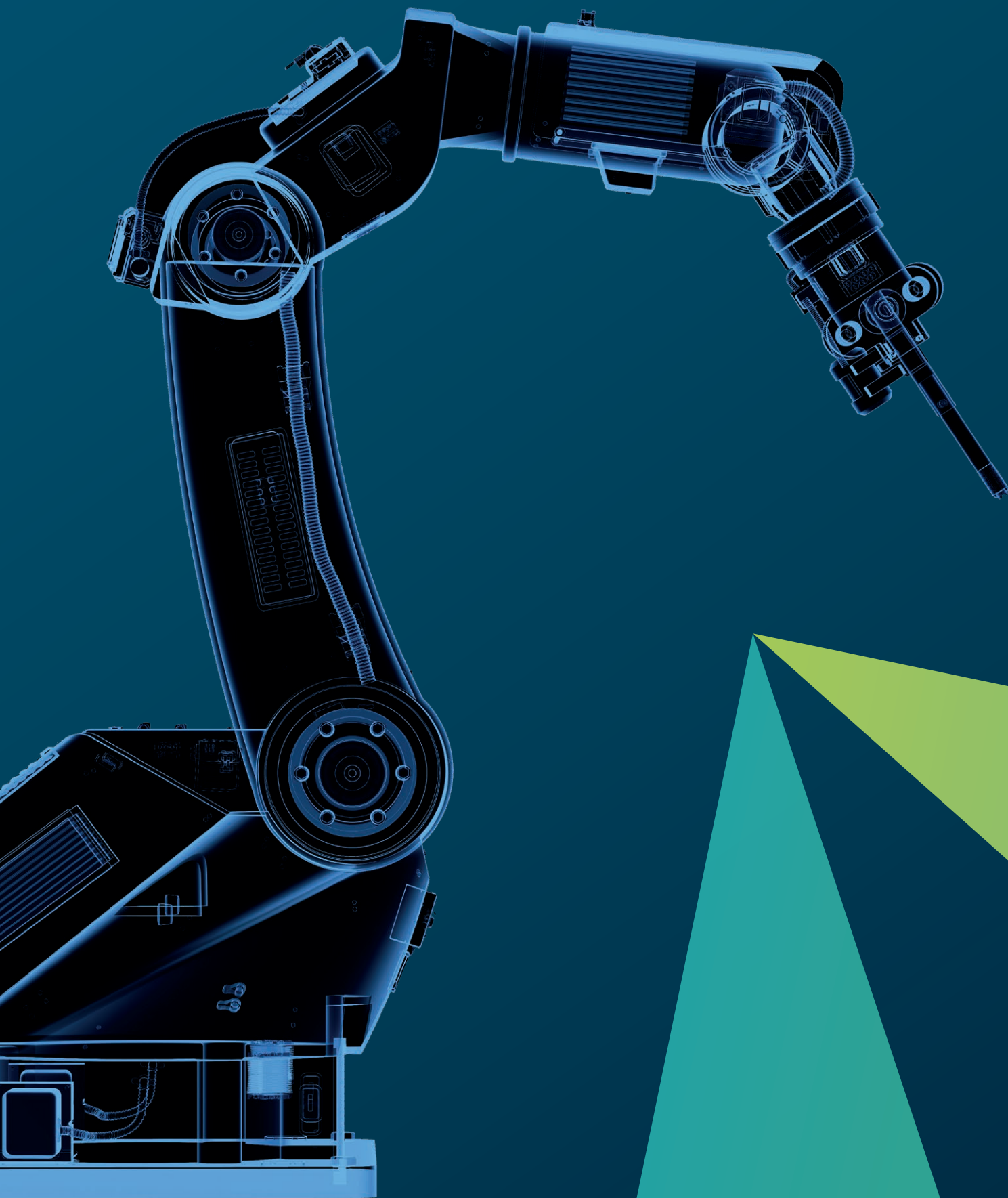


06 / Export analysis results as .glb files

The “Results as textured mesh” option exports the results of supported analyses as .glb files. Seamlessly transfer your results to other software, such as Windows 3D Viewer or PowerPoint, to visualize 3D objects. Unlike exporting colored meshes, this option uses textures instead of vertex colors, which results in much smaller file sizes and smoother support in third-party applications.

Benefits

- Informative combination of traceability data, numerical results, and 2D images
- Customizable content and level of detail for either management or technical experts
- Connectivity to third-party systems for all reported data



Automation

with VG software

Overview

Inspect your parts automatically and non-destructively with industrial computed tomography (CT) and VG software. It's simple to set up and works with almost every CT system on the market.

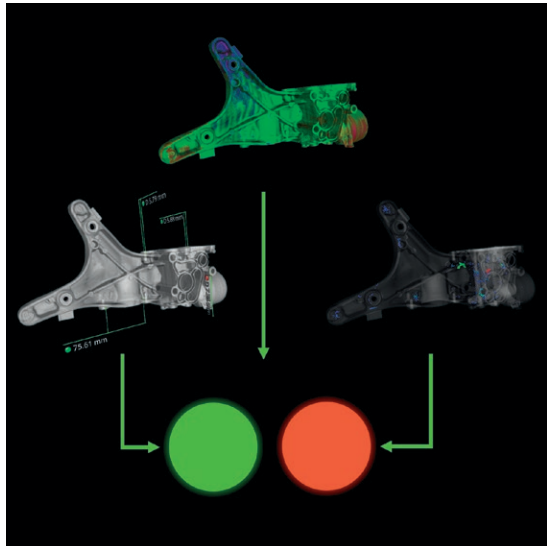
We offer a ready-to-use solution that is both fast and flexible: Whenever parts need to be analyzed repeatedly, powerful automation functions will be at your side to speed up your work — from the semi-automated sample tests in quality labs and small batch series inspection to fully automated 100% inspection on the shop floor.

Automation features

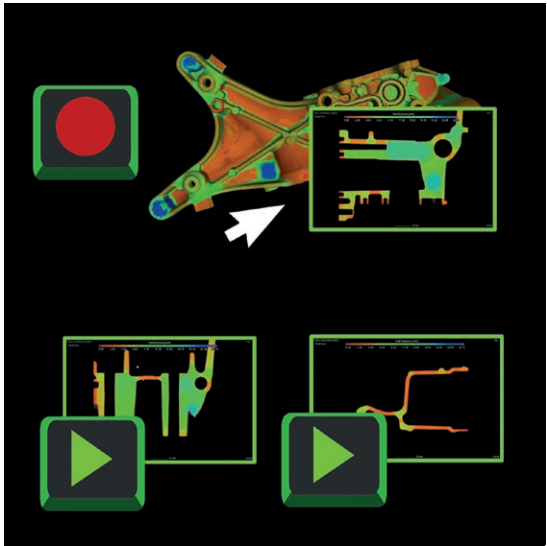
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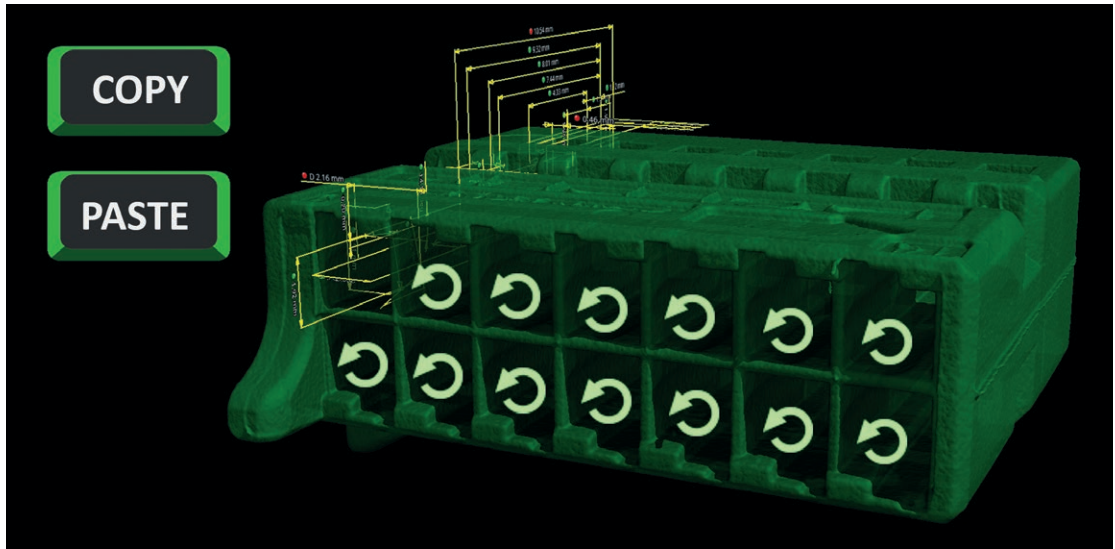
01



02



03



01 / Templates

Combine geometry elements, features, and dimensions into reusable measurement templates. Reusable analysis templates combine parameters, tolerances, and other settings of gray value or surface analyses. You can define different views on your data, switch between them, and store them in reusable bookmark templates.

02 / Macros

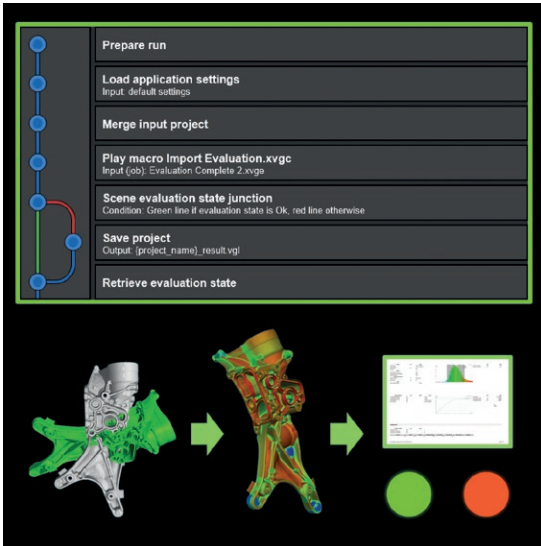
Record individual interactions with the software for storage and later use across different projects and application restarts. You can combine, shorten, or append macros and edit their input dependencies as well as file outputs for later adjustments. Play back previously recorded macros at any time to optimize your workflow and share them with colleagues for standardization.

03 / Automated workflows

Copy complete measurement or analysis templates to similar areas within a single part to inspect repeating features. With automated workflows, you can apply macros that contain more complex operations to multiple scans of similar objects in a single project. Simplify manual inspections by combining recurring operations into macros that can be triggered via shortcuts and remain despite application restarts.

Automation features

04



05



04 / Inspection plans

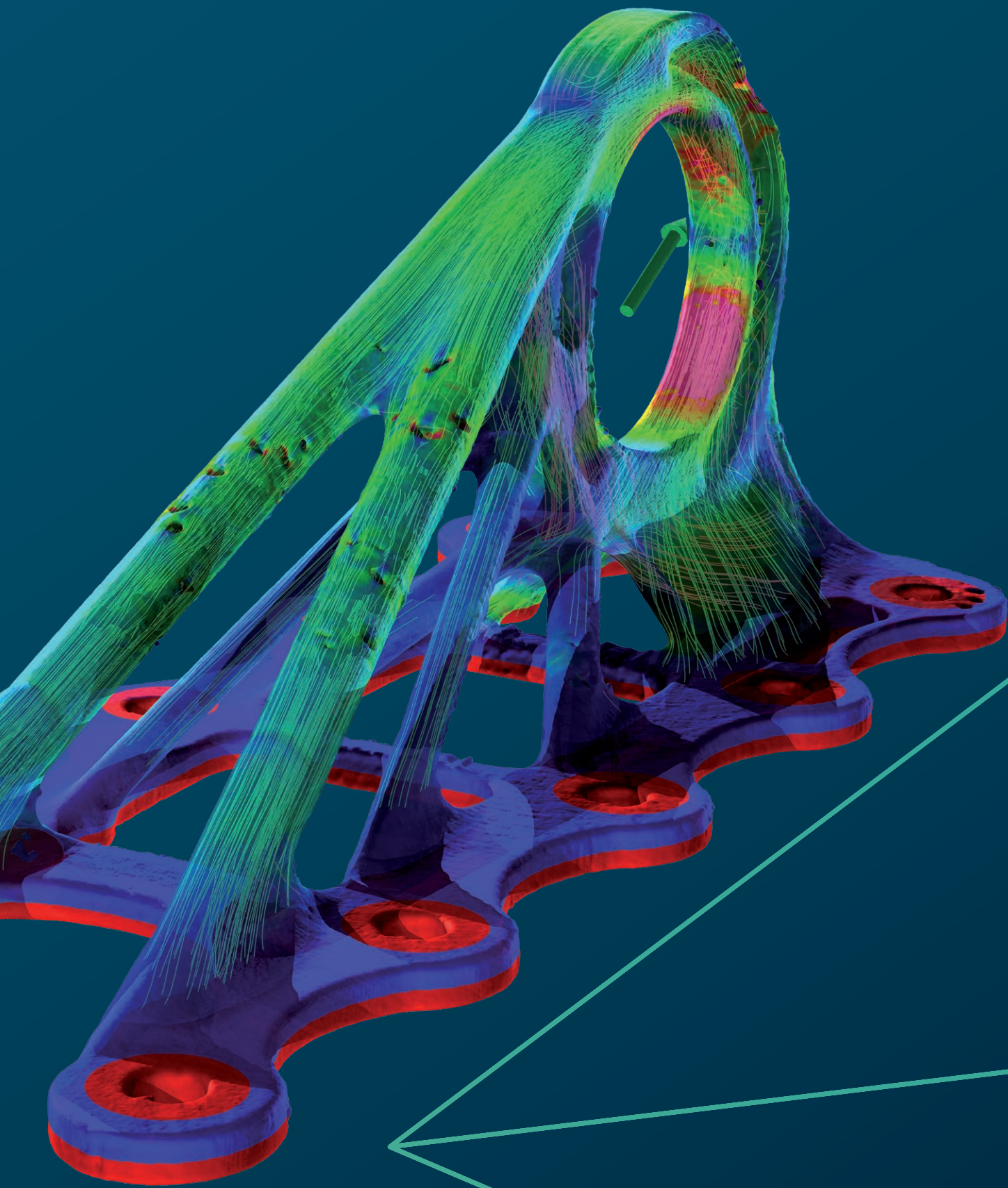
Join macros, templates, and other dependencies like reference meshes to create completely self-contained inspection plans. Inspection plans enable you to easily inspect a series of parts by applying plans to a batch of projects, generating unique output such as reports or result projects for each plan. Create advanced plans that perform operations dependent on intermediate results to optimize performance or generate more in-depth results.

05 / VGINLINE automation

Transfer inspection plans to the fully automatable VGINLINE system and automatically process any incoming input using one or more workstations. You can define different revisions of inspection plans to account for part variations and switch between them. VGINLINE enables you to automatically export results to auxiliary systems like the web-based VGINLINE APPROVER for manual review or to software for statistical process control using the Q-DAS ASCII data transfer format.

Benefits

- Save time and reduce potential errors in recurring inspections of the same parts
- Save time for repeated operations within single parts, multiple parts in a single project, or across whole batches of projects
- Easily transition from manual to semi-automated and fully automated inspection scenarios



Simulation

with VG software

Overview

Simulate directly on CT data or prepare your CT data for export for simulation purposes.

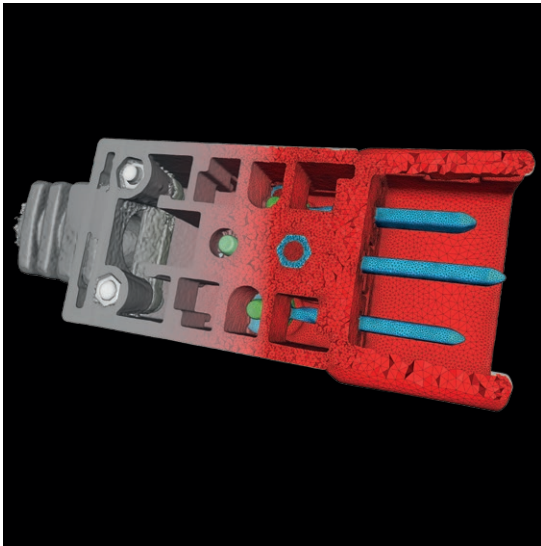
Our software gives you the tools to check your simulation workflows. Perform virtual stress tests or microstructure-level virtual flow and diffusion experiments directly on CT scans, or create high-quality tetrahedral volume meshes for FEM simulations in third-party software.

Simulation features

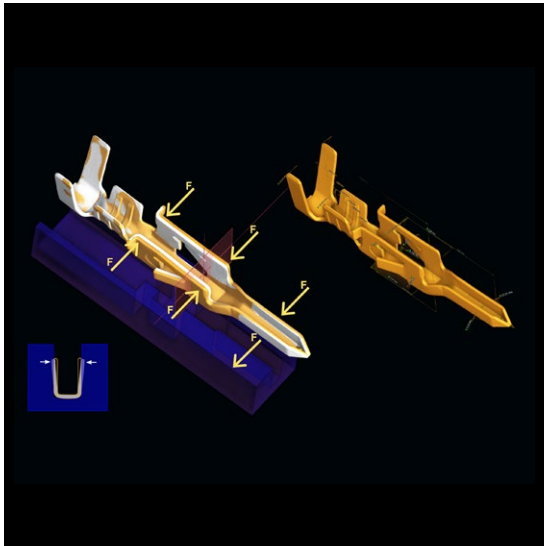
Scan for more
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01



02



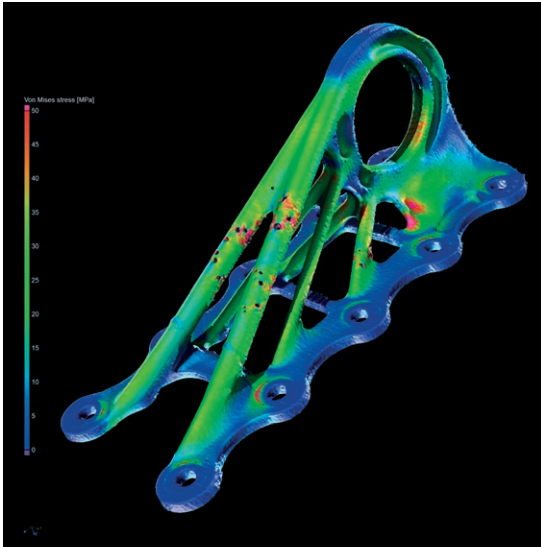
01 / Volume meshing

Create accurate and high-quality tetrahedral volume meshes directly from CT scans of single-material and multi-material components or material samples. Volume meshes can be used for mechanical, fluid, thermal, electrical, and other simulations in third-party FEM simulation software. Works directly on the volume data of the CT scan without the need to create an intermediate surface mesh — thus avoiding a loss of geometry information and accuracy.

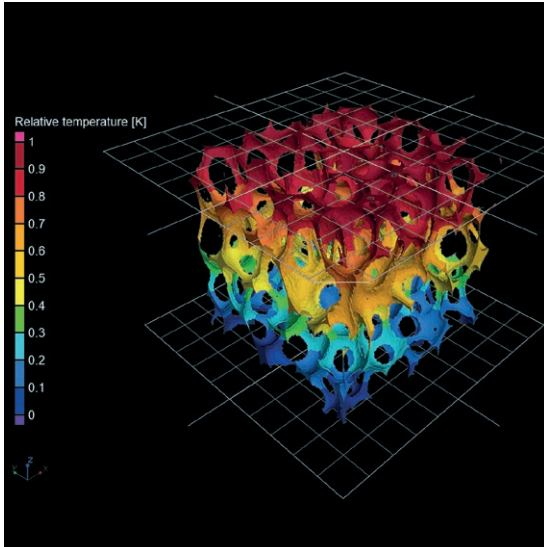
02 / Fixture simulation

Do you have a deformed part and want to know if it would still be in tolerance after assembly? The Fixture Simulation module enables you to virtually simulate the assembled state of the part and directly apply the classical metrology workflow to these results, reducing scrap and eliminating the cost of physical clamping devices.

03



04



03 / Structural mechanics simulation

Perform FE stress simulations directly on CT scans. The structural mechanics simulation provides an easy-to-use simulation model that is particularly suitable for highly complex structures such as foams, lattice structures, or components with microporosity, since no geometry-conforming mesh is needed. With one click, you can include the results of a porosity analysis to simulate stress concentrations around defects. Results have been validated against experimental tests and classical FEM simulations.

04 / Thermal conductivity simulation

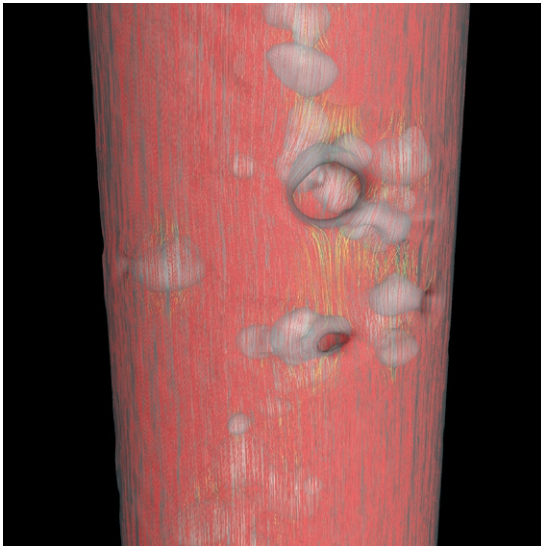
Simulate the stationary temperature and thermal flux fields in a porous or two-component material directly on a CT scan. With thermal conductivity simulation, you can perform virtual experiments on the CT data of a structure that simulate the transport of heat through the structure. The software enables you to calculate homogenized thermal conductivity on material samples and the local and global effective tensor-valued thermal conductivity.

Simulation features

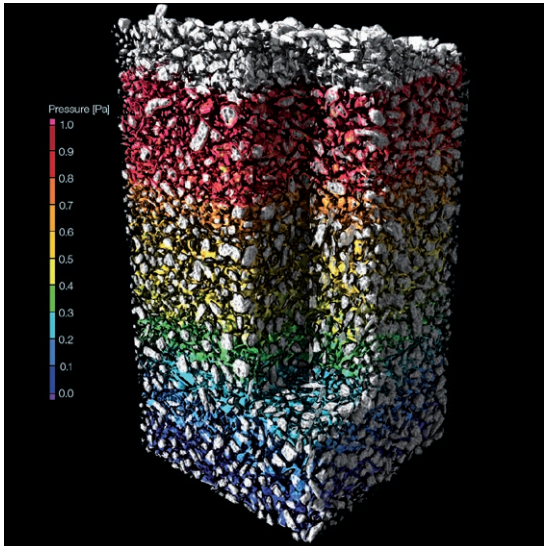
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04



05



04 / Electrical conductivity simulation

Simulate the stationary electric potential and current fields in a porous or two-component material directly on the CT scan. With electrical conductivity simulation, you can perform virtual experiments on the CT data of a structure that simulate the transport of electrical charge through the structure. The software enables you to calculate homogenized electrical conductivity on material samples and the local and global effective tensor-valued electrical conductivity.

05 / Transport phenomena simulations

Simulate various other transport phenomena, such as fluid flow or molecular diffusion through complex structures. With VG software, you can simulate the stationary laminar flow of an incompressible single-phase fluid through the voids of a porous material, calculate the capillary pressure drainage curve for a scanned porous material sample, and compute the diffusion of molecules through a porous material sample from a region of higher concentration to one of lower concentration.

Benefits

- Accurate and detailed representation of complex structures based on subvoxel-accurate material segmentation
- Intuitive, even for those new to simulation
- Seamless and efficient workflow in one software — from material segmentation to simulation

Product selection

Find your ideal solution

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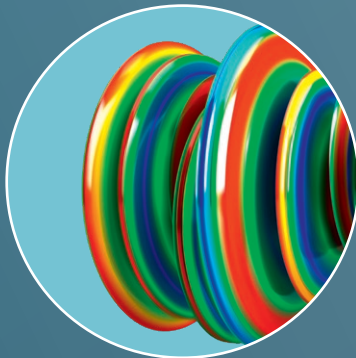


Free viewer applications



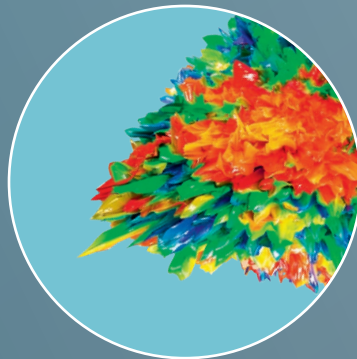
VGSTUDIO MAX

Modular software suite offering the complete spectrum of VG functionality



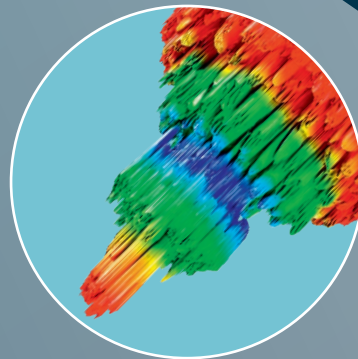
VGinLINE

For fully automated inspection of CT data on the shop floor



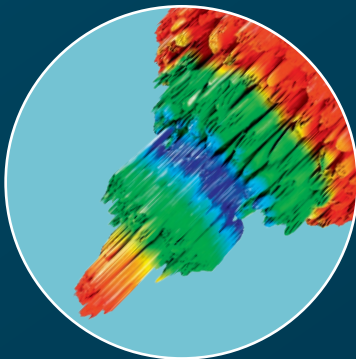
myVGL

For viewing all inspection results



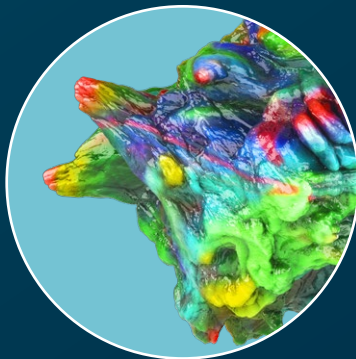
VGMETROLOGY VIEWER

For viewing dimensional inspection results



VGMETROLOGY

For GD&T in dimensional metrology departments

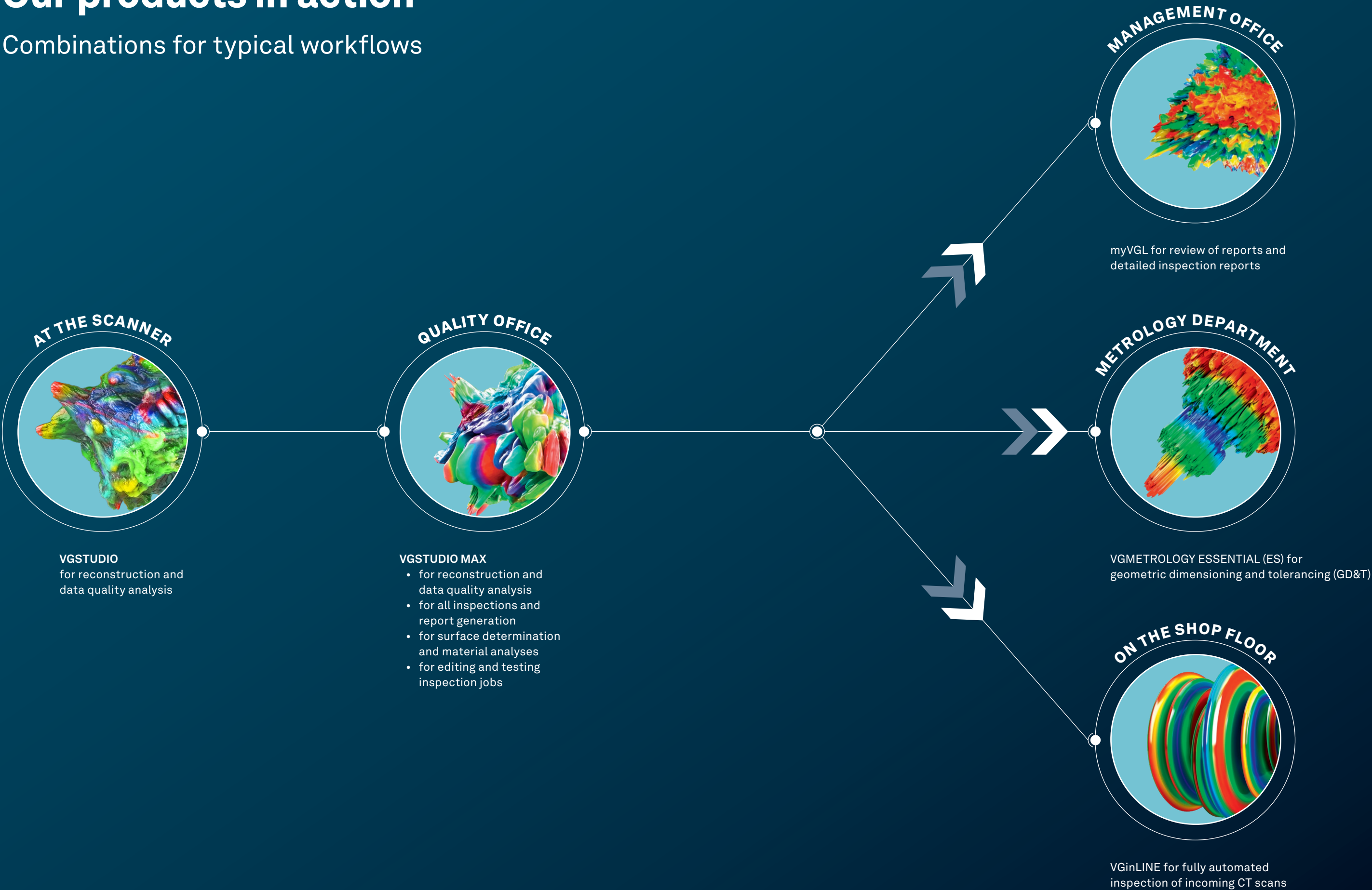


VGSTUDIO

For reconstruction and visualization of CT data

Our products in action

Combinations for typical workflows



Your needs, our solutions

No matter which insights you need from your products, the configuration options in VGSTUDIO MAX will get you there your way.*

Basic edition

Your starting point is the basic edition. It offers innovative measuring instruments, visualization capabilities for visual inspections, reporting and presentation functions.

Add-on modules

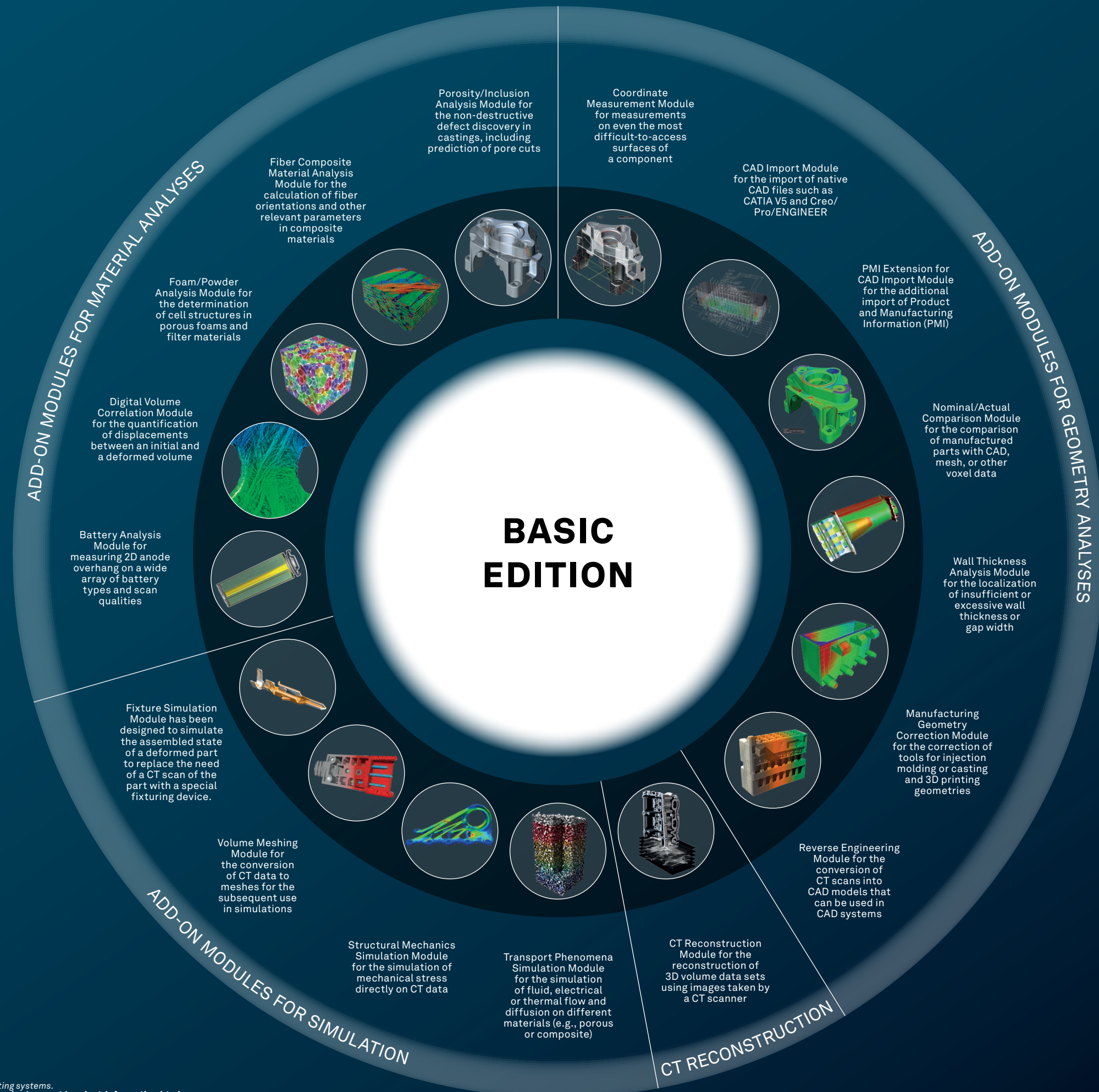
Choose from a wide selection of modules for material analysis, geometry analysis, simulation, and CT reconstruction. And if your needs grow, so can VGSTUDIO MAX.

Packages and bundles

To make it even easier, VGSTUDIO MAX is available in preconfigured packages tailored to the most common application areas. A package includes a VGSTUDIO MAX license, a selection of add-on modules, and a one-year update/service agreement. If you already own a VGSTUDIO MAX license, you can add a preconfigured bundle to your VGSTUDIO MAX. A bundle consists of a selection of add-on modules and a one-year update/service agreement.

Ever-evolving

VGSTUDIO MAX is always getting better, with new features rolling out regularly. With our optional update/service agreement, you can keep up with current developments in the analysis and visualization of industrial CT data while still saving money compared to the regular upgrade price.



*Depending on the platform, there are differences in the range of functions for different operating systems. See our continuously updated Product Information page for details: www.volumegraphics.com/en/support/product-information.html.

Packages

VGSTUDIO MAX tailored to your area of application

Packages and bundles

- Preconfigured for the most common tasks within various industries
- Considerable savings compared to buying individual modules separately
- Package: includes a VGSTUDIO MAX license, a selection of add-on modules, and a one-year update/service agreement
- Bundle: consists of a selection of add-on modules and a one-year update/service agreement

Packages/ bundles	Geometry	Battery	Material	Cast & Mold
Includes	For metrology and quality control in a variety of industries	For precise measurements, ensuring battery cells' optimal performance and lifespan.	For lightweight construction and materials research	For casting and injection molding, esp. in the automotive and aerospace industry
Coordinate Measurement	●	●	●	●
Nominal/Actual Comparison	●	●		●
Wall Thickness Analysis	●	●		●
Manufacturing Geometry Correction				
Reverse Engineering				
Fixture Simulation				
CAD Import*				
PMI Extension for CAD Import*				
Porosity/Inclusion Analysis		●	●	●
Fiber Composite Material Analysis			●	
Foam/Powder Analysis			●	
Digital Volume Correlation				
Volume Meshing				
Structural Mechanics Simulation				
Transport Phenomena Simulation				
Battery Analysis		●		
CT Reconstruction				
IAR** for CT Reconstruction				

*CAD Translation Technology supplied by Tech Soft 3D

**Cone/Fan/Parallel Beam, Special Algorithms (Helix, ART), and Planar

System requirements

- VGSTUDIO MAX runs on modern, off-the-shelf PCs and is available for Windows and Ubuntu Linux.* Please visit our website to read up on the latest system requirements: www.volumegraphics.com

Packages/ bundles	Composites & Plastic	Additive Manufacturing	Universal	Ultimate
Includes	For industries working with plastic injection molding and fiber composite materials	For the inspection of additively manufactured parts, including powders	For advanced users in quality assurance labs who face different analysis and measurement tasks as part of their daily work	For advanced users who need it all
Coordinate Measurement	●	●	●	●
Nominal/Actual Comparison	●	●	●	●
Wall Thickness Analysis	●	●	●	●
Manufacturing Geometry Correction			●	●
Reverse Engineering			●	●
Fixture Simulation				●
CAD Import*				●
PMI Extension for CAD Import*				●
Porosity/Inclusion Analysis	●	●	●	●
Fiber Composite Material Analysis	●		●	●
Foam/Powder Analysis		●	●	●
Digital Volume Correlation			●	●
Volume Meshing			●	●
Structural Mechanics Simulation			●	●
Transport Phenomena Simulation				●
Battery Analysis				●
CT Reconstruction**			●	●
IAR*** for CT Reconstruction				●

***Technology licensed by Fraunhofer EZRT

License models

The right licensing model for every requirement

Floating

Use software flexibly across the world, a continent, a country, or one location.

Depending on the model you choose, our floating license models allow you to use a single license worldwide, continent-wide, country-wide, or within one location. This increases your license utilization and reduces license management effort.

All floating license models allow for offline borrowing of a license from your floating license pool for up to 7 days, such as for a business trip or a conference. One user can run multiple instances of the software on the same computer without each one counting as a separate license. Each license may include different functions.

Please note: The license server for the Floating Licenses is available free of charge and can also be installed on a virtual server. If you already have a Flexera server, you can also use it for VG software.

Available for: VGSTUDIO MAX, VGMETROLOGY, and VGMETROLOGY ES

Node-locked

Use software exclusively on a specific computer.

If you know exactly what you need and where you'll need it, we recommend a Node-Locked License. The software is installed on the computer on which it is currently used. The Node-Locked License binds the software to this computer.

A Node-Locked License allows one user to run multiple instances of the software on one computer.

Please note: once installed, the computer and platform are fixed.

Available for: VGSTUDIO MAX, VGSTUDIO, VGMETROLOGY and VGMETROLOGY ES.

Global floating

If you are a global company and want to use a single license worldwide at different locations in different time zones, Global Floating is the perfect license model for you. Compared to other license models, Global Floating requires fewer licenses, since you can use one license throughout the world.

Continental floating

If you are a company with multiple sites across one continent, you can share licenses across one continent. Continental Floating Licenses are available for usage in the Americas, EMEA (Europe, the Middle East, and Africa), or the Asia-Pacific region.

Country floating

If your company requires licenses for users in a specific country, we recommend the Country Floating License. This license covers either an entire country or — in the case of the territorial states Russia, Australia, India, Canada, the United States of America, and Mainland China — a specific territorial region of a country.

Local floating

If your company employs several users at one location who do not use the software full-time, these employees can share Local Floating Licenses. Compared to a Dongle License, the Local Floating License requires no effort to transport the dongle and avoids the risk of losing it.

Dongle license protection

To minimize costs should your dongle become lost or stolen, we offer Dongle License Protection with a term of 12 months. In the event of loss, we will provide you with a new dongle and a new license for the remaining term for a fee of 2% of the original list price of the software plus the applicable VAT per month or part thereof and a fixed handling fee.

Dongle License Protection is available for an annual fee or free of charge on request if you purchase an update/service agreement.

Update/service agreement

The update/service agreement keeps your software up to date at a reasonable price. Keep up with all current developments in the analysis and visualization of industrial CT data and save money compared to the regular upgrade price.

During the one-year term of the update/service agreement, you will receive all upgrades and bug fixes free of charge. In addition, you will enjoy priority support.

Available for: VGSTUDIO MAX, VGSTUDIO, VGMETROLOGY, VGMETROLOGY ES, and VGinLINE.

	Global Floating	Continental Floating	Country Floating	Local Floating	Node-Locked	Dongle
Summary	For global companies	For companies with multiple sites across one continent	For companies with users in a specific country	For companies with multiple users in one city	For use on a specific computer	The easiest way to use software alternately on multiple computers without a network connection
Available for	VGSTUDIO MAX, VGMETROLOGY, VGMETROLOGY ES	VGSTUDIO MAX, VGMETROLOGY, VGMETROLOGY ES	VGSTUDIO MAX, VGMETROLOGY, VGMETROLOGY ES	VGSTUDIO MAX, VGMETROLOGY, VGMETROLOGY ES	VGSTUDIO MAX, VGSTUDIO, VGMETROLOGY, VGMETROLOGY ES	VGSTUDIO MAX, VGSTUDIO, VGMETROLOGY, VGMETROLOGY ES, VGinLINE
Use on multiple computers	●	●	●	●		●
Floating within a network that extends across...	...the world	...one continental time zone range (Americas, EMEA, or Asia-Pacific)	...either an entire country or a specific territorial region of a country (in the case of the territorial states Russia, Australia, India, Canada, the United States of America, and Mainland China)	...one location		
Multiple instances on one computer for one user	●	●	●	●	●	●
Usable without network connection	○ (temporarily)	○ (temporarily)	○ (temporarily)	○ (temporarily)	●	●
Supports virtual license servers	●	●	●	●		
Hardware-independent	●	●	●	●	(computer-bound)	(dongle-bound)
Platform-independent	●	●	●	●		●

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Technical consulting

Insightful expertise you can rely on

Our 20+ years of experience working in industrial CT and 3D imaging technologies have given our consultants insightful expertise you can rely on. Our Technical Consulting Team can help you use CT hardware and VG software to answer your questions in a way that's ideally tailored to your particular needs.

We evaluate the specific requirements for your applications, create the optimal software configuration and general CT hardware specification, and even offer complete evaluations as a contract service.

Consulting for system purchases

If you don't have a CT system yet, we will work with you to evaluate whether your task can be solved with CT and, if so, how. We translate your needs into reliable technical specifications, taking feasibility, budget, material to be inspected, required resolution, location (close to production or laboratory), and other relevant requirements into account.

Consulting for complex tasks

For more complex questions, like on the extension of existing systems or new purchases, we will prepare a feasibility study and check how realistic your idea is and how it can best be implemented using our software.

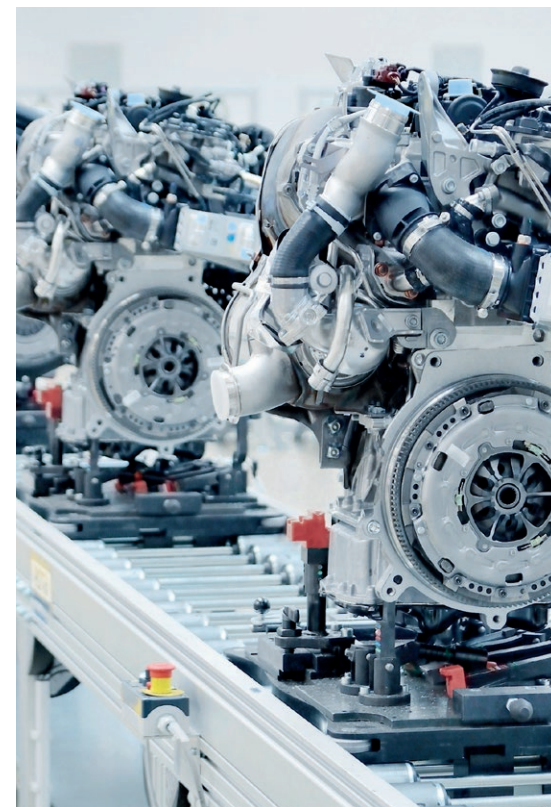
Services for analysis and visualization

Our consulting team analyzes your CT data according to your requirements. If it's necessary, we can refer you to a scanning service provider.

Services for VGinLINE

Especially in the automation of inspection procedures, we support you by providing the necessary technical know-how. Together, we provide the basis you need to best solve your inspection tasks with maximum efficiency.

If you're working with us on a larger automation project using VGinLINE, we can create the inspection plan according to your requirements. In cooperation with VG Academy, we can also train you in the everyday use of VGinLINE — all while guiding you throughout the process of purchasing your VGinLINE system.



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information:



Learn to inspect better

VG Academy has one goal: to enable you to better solve your inspection tasks with our products. We can help you work more confidently and efficiently with your VG software. Simply sign up for one of our various training courses!

All courses are available in German and English. Please contact us if you require training in other languages.

Training Locations

- VG Academy Locations:
 - Heidelberg, Germany
 - Charlotte, NC, USA
 - Nagoya, Japan
 - Beijing, China
 - Singapore
- VG Academy E-Learning
- On-site at your office

Training options

- Basic training courses for VGSTUDIO MAX
- Boot camps and individual workshops
- Train-the-Trainer (for VG partners)
- ... and much more

How to sign up

If you wish to participate in a training course or if you have any further questions, please contact us via e-mail at academy@volumegraphics.com or by phone +49 6221 73920-810.



Volume Graphics, part of Hexagon, is a global leader in the development of software for non-destructive testing based on industrial computed tomography (CT). Customers around the world across all manner of applications and industries use our software for quality assurance in product development and production. Visit volumegraphics.com to learn more.

Hexagon is a global leader in digital reality solutions. Learn more about Hexagon (Nasdaq Stockholm: HEXA B) at hexagon.com and follow us [@HexagonAB](https://twitter.com/HexagonAB).