VGStudio MAX 3.0

THE MARKET’S LEADING APPLICATION SOFTWARE FOR ANALYSIS AND VISUALIZATION OF INDUSTRIAL COMPUTED TOMOGRAPHY/VOXEL DATA
Volume Graphics GmbH was founded in 1997 in Heidelberg, Germany, where its headquarters are to this day. The core business of the company is the development and marketing of software products for the analysis and the visualization of industrial and scientific computed tomography (CT) data. The main software solutions offered are VGStudio MAX and VGStudio. Both software products can be enhanced with various add-on modules. Since the beginnings of the use of computed tomography in industrial applications, Volume Graphics has influenced and pushed the boundaries of what has been thought possible within this ever growing market segment. Today, Volume Graphics is the leading software provider world-wide in this field.

In addition to its off-the-shelf products, Volume Graphics is a competent partner for questions and application advancements in the area of industrial computed tomography. With our extensive know-how stemming from more than 15 years in the business we have become an esteemed partner offering custom solutions and consulting services for a wide range of applications.

Industries & Markets:
- Automotive industry
- Aerospace industry
- Consumer and household electronics industries
- Life sciences/healthcare
- Light alloy and injection molding industries
- Universities, academic and industrial research institutes as well as museums
- ...

The Volume Graphics product line for industrial and scientific computed tomography has grown to five software applications: VGStudio MAX, VGStudio, VGMetrology, VG InLine and myVGL.

VGStudio MAX is the most comprehensive tool, enabling the user to analyze, measure, segment and compare voxel data sets.

VGStudio is the inexpensive entry level product to the world-wide standard of industrial and scientific voxel data processing and visualization. VGStudio can be upgraded to VGStudio MAX and can therefore ‘grow’ with the users’ requirements for advanced analysis tools.

VGMetrology is the latest addition to the Volume Graphics product portfolio and has been designed as a stand-alone metrology application. It works directly on the extracted surface of your scanned parts and offers loss-free precision for applying measurement plans on files that require only a fraction of available disc space than conventional voxel data sets.

VG InLine is a new analysis software solution that is especially geared towards the demands of at-line/in-line inspection scenarios. VG InLine comprises all currently available analyses for complex metrology applications, nominal/actual comparisons and material analyses. Whether they are carried out on plastic or on lightweight/moulded parts, VG InLine offers inspection reliability at production speed.

Finally, myVGL is the 3D viewer that can be installed on any standard PC for presenting projects created using VGStudio MAX, VGStudio, VGMetrology and VG InLine. With myVGL a user can thus easily share analysis results with colleagues, partners and customers who have not licensed any other Volume Graphics software product.

All of Volume Graphics’ software solutions have been developed with the user in mind and have proven their value in various industries and scientific fields.

Thus VGStudio MAX and its sister products have revolutionized the way industrial CT/voxel data is utilized: very large data sets can now be handled quickly and interactively. With its unique features and module options, VGStudio MAX allows large CT data sets to be processed within very few minutes. Even the largest data sets with more than 100 GB can be processed on off-the-shelf PC hardware.
FACTS ABOUT VGSTUDIO MAX

VGStudio MAX is the world’s most advanced software platform for industrial CT data analysis and visualization. It incorporates Volume Graphics’ latest VGL® kernel technology – knowledge and experience gathered from thousands of installations worldwide.

VGStudio MAX:

- Allows users to perform material- and geometry-related analyses of their CT/voxel data sets within one single software environment.
- Supports the combined processing of CT, point cloud, mesh and CAD data.
- Offers software tools for direct processing of voxel data sets – there is no need to convert voxel data into other data formats such as point clouds or surface meshes. This direct processing reduces measurement uncertainty and improves overall processing time, which is especially important in serial inspection or in-line CT data analysis.
- Supports macros, inspection templates and ‘Regions of Interest’ for efficient processing of serial inspection tasks.

Examples of the extensive functionality of VGStudio MAX:

- Sub-voxel precise surface determination, enabling industry leading accuracy, e.g., for metrology applications.
- Unsurpassed segmentation tools for the separation of materials and geometries within a data set.
- Macro/batch processing.
- Powerful reporting options for the generation of detailed reports containing user-defined information for every measured feature.
- Coordinate measurement for 2D and 3D dimensioning (optional module), GD&T functionality.
- Nominal/actual comparison for comparison with CAD data, such as STEP, IGES (optional module) directly on the voxel data.
- Integrated CAD kernel for importing STEP or IGES files (basic license) or native CAD formats and PMI data (optional module).
- Automatic discontinuity analysis for porosity/inclusion detection (optional module).
- Wall thickness analysis (optional module).
- Fiber composite material analysis (optional module).
- NEW Foam structure analysis (optional module).
- NEW Calculation of transport phenomena (optional module).
- High performance CT reconstruction (optional module).
- Export of point cloud or mesh data (e.g., STL) for rapid prototyping and rapid engineering.
The basic version of *VGStudio MAX* and its functionality

*VGStudio MAX* already comes equipped with numerous clever features that make working with CT data and presenting analysis results more comfortable than ever before. We have taken a close look at what our users want to do with their data sets and have come up with various ways to help them get there as fast and easy as possible.

### VARIOUS ANIMATION OPTIONS

The unsurpassed and award-winning high-quality 3D and 2D visualization in *VGStudio MAX* has been featured extensively in media and TV productions. For the creation of impressive animations of your volume data in *VGStudio MAX* you can choose between two different animation tools. An intuitive keyframer tool allows you to create all kinds of animations, presenting data and analysis results in a most impressive way. Even for inexperienced users, the simple keyframer tool provides the possibility to generate striking 3D animations.

**NEW** Videos from the slice image stacks are created with a few mouse clicks, where you will now be able to optionally choose a picture-in-picture view for illustrating the exact position of the respective slice within the 3D model.

**NEW** A new Object Exploder allows for quickly animating explosion diagrams of segmented objects. Thus this very popular way to illustrate complex structures within a scanned part will be only a couple of mouse-clicks away.

Finally, Volume Graphics can also create impressive animations as a paid service. Ask us for references and a quote.

### NON-PLANAR VIEWS AND THICK SLAB OPTION

With *VGStudio MAX*, 2D views are no longer limited to simple planar slices through the object. With the Non-Planar View mode, round or even irregularly curved objects can now be unrolled or projected along their surface in a ‘flat’ 2D view. A cylindrical object, for example, can be viewed as a stack of ‘unrolled slice images’.

The 2D window Thick Slab View option allows you to view a stack of slice images with user-defined thickness in minimum, maximum or average projection mode.

### BOOKMARKS

The Bookmark concept lets you switch easily between different views of your project. With this feature, presenting a set of CT data analysis results to your customers is only one click away. By creating a new bookmark item, the state of the corresponding 3D and 2D views, object and analysis visibility settings, clippings, selection of coordinate systems and rendering settings will be automatically stored. Bookmarks help you organize projects with different areas of interest as well as complex projects with multiple objects and/or analyses and measurements. With this functionality, a person reviewing results of an inspection process can be systematically guided through complex analysis scenarios, directing the focus and attention to the points of interest. Moreover, bookmarks are compatible with *myVGL* in cases where your business partner has no access to a licensed version of *VGStudio MAX*.

Use Bookmarks to organize and disseminate your projects

The cylindrical surface of a bottleneck has been unrolled to view it in a ‘flattened’ slice image
Automated inspections using VGStudio MAX

For users who need to examine entire series of parts according to predefined standard specifications, VGStudio MAX provides a large number of tools allowing even the most complex analysis tasks to be performed automatically.

EVALUATIONS

VGStudio MAX has a function to create a single ‘comprehensive inspection plan’ of a part that we call ‘evaluation’. Evaluations combine a wide range of different analyses, measurement templates and regions of interest including the analyses they contain. Thus, evaluations allow for the results of the most diverse analysis tasks such as wall thickness and porosity analyses to be logically connected in order to achieve more conclusive accept/reject decisions. Evaluations are the prerequisite to use VGStudio MAX in semi and fully automated testing procedures with unsurpassed efficiency to its full extent, i.e., with all measuring and analyses functions.

Our evaluation concept is also the basis for the efficient use of our software solution for automated inspection tasks, VG InLine, where the evaluations generated with VGStudio MAX can be put to use for serial inspections.

MACROS AND TEMPLATES

Complex analysis procedures can be saved as macros. In addition, complex measurement plans or analysis parameterizations (e.g., porosity or fiber orientation analyses) can be saved as templates. These can later be used either manually or in macros in order to achieve reproducible results with as little user interference as possible.

BATCH PROCESSING

Series of CT data sets, e.g., of injection-molded parts from multi-cavity molds, can be batch processed in VGStudio MAX. Batch processing uses macro and template functionality and allows large series of data sets to be examined in a fully automated way and without any further user interaction.

CT SCANNER SOFTWARE INTEGRATION AND PROCESS AUTOMATION

Volume Graphics offers a Software Development Kit (SDK) that can be integrated in the CT scanner’s system control software. The integrated SDK allows you to start VGStudio MAX with the scanned data set directly as a VG project. In addition, it is able to execute macros, e.g., to initiate automated inspection tasks, from a simple analysis of wall thicknesses or the detection of molding sand in castings to highly complex inspection tasks combining material-related analyses with a comprehensive geometry analysis of parts.

The SDK is therefore the clever prerequisite for easily setting up a fully automated in-line/at-line inspection system. Most of our CT hardware partners already have implemented our SDK in their installations.

NEW COMBINED ANALYSES

If you are using VGStudio MAX with several different analysis modules you will now be able to perform so-called combined analyses. This new option takes into consideration the result of one analysis when performing a follow-up analysis with another module. This way you will be able to perform, e.g., a wall thickness analysis and then combine a porosity/inclusion analysis. A defect will then not only be classified according to size but will be reclassified according to its size relating to the local wall thickness. The fiber composite material analysis and the porosity/inclusion analysis can be combined in such a manner, too, in order to help you reach even more realistic quality conclusions.

NEW ACTIVE COLUMNS AND CATEGORIES

In VGStudio MAX 3.0, we have implemented a new option for displaying analysis results that we have called Active Columns Concept. You will now be able to choose the parameters that you want to be the basis for color coding your findings in the visualization by clicking the respective column in the result list. This way you can, e.g., switch between classifying the volume of a defect or its diameter at the click of a mouse.

Also new in Version 3.0 are so-called Categories, where you will be able to define color tables with their own distinct increments within one analysis.
**SEGMENTATION TOOLS**

*VGStudio MAX* comes with a set of powerful segmentation tools allowing data sets to be separated into several so-called ‘Regions of Interest’ (ROI) that usually consist of different components, materials, etc.

Segmentation is the basis of many data analysis projects. It is therefore one of the most important features that helps users to solve their tasks. For example: you want to perform a porosity/inclusion analysis on a molded part. It is likely that in this case you want to measure the local volume fraction of your pores and inclusions. Here, segmentation tools enable the user to form an ROI within which to run the analysis. All data analysis and visualization tools of *VGStudio MAX* can take advantage of the ROI concept.

If you are used to pixel-based picture manipulation tools, the approach of *VGStudio MAX* to segmentation will be familiar: available segmentation tools include manual marquee and drawing-style tools as well as semi-automated tools (e.g., a so-called region grower). ROI refinement and smoothing tools, morphological operators and functions that utilize CAD models or their component structure to be used for segmentation will further support you in the segmentation of your part. *VGStudio MAX* comes with sub-voxel precise segmentation capabilities thus further increasing the precision of all data analysis tasks.

**ENHANCED SURFACE DETERMINATION**

**REQUIRES COORDINATE MEASUREMENT MODULE**

With its high precision, local adaptive surface determination algorithm, *VGStudio MAX* is already considered to be the industry’s standard. Only Volume Graphics can draw back on more than 15 years of experience which results in advanced algorithms that allow for measurements on CT data to be performed with a minimum of uncertainty. This has been confirmed by many users and laboratories worldwide. VG’s surface determination algorithm offers highest accuracy, which leads to better results especially in high-contrast, high-dynamic range CT data, e.g., data resulting from scans of multi-material assemblies. In combination with the enhanced Coordinate Measurement Module, *VGStudio MAX* has set a new reference mark for CT measurement accuracy.

Surface determination

Steps are caused due to voxel-based segmentation

No steps due to enhanced surface determination and sub-voxel precise segmentation
New Modules for **VGStudio MAX 3.0**

Two new add-on modules will be available for the upcoming new version of **VGStudio MAX**. Both of these modules will help you determine quality characteristics by way of applying a suitable method of quantification. With both modules we continue on our path to open CT data analysis even further towards the world of simulation. Thus they are ideally suited for engineers and researchers, who require a more detailed insight into the internal structures of complex materials.

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**NEW FOAM STRUCTURE ANALYSIS MODULE**

The Foam Structure Analysis Module is dedicated to the analysis of porous materials, like foams or filter materials. It can be used, e.g., for segmenting the CT data in cells, edges and contact surfaces and provides numerous statistical values for further analysis. Employing this specific module, a user will be able to calculate the cell size, surface area, edge direction and thickness distribution of the foam cells in a material probe to be inspected and display and plot the results in various ways.

Furthermore, these other global characteristics can be calculated:

- Average cell volume, surface and diameter.
- Average contact surface area and diameter.
- Average edge length and thickness.
- Euler numbers and characteristics.
- Average and total curvature and many more.
- Sub-voxel precise computation, supporting VG’s ‘Region of Interest’ concept.
- ...
The Transport Phenomena Module represents the result of VG’s extensive R & D in voxel data based simulation tools. The Transport Phenomena Module computes physical material properties by numerical simulation and will help you, e.g., in quantifying and analyzing properties of different phases in a material. The Transport Phenomena Module computes material properties directly for simulating grid mesh cells (imported via NASTRAN, PATRAN).

To this end you will be able to calculate phenomena like:

- Absolute permeability: fluid flow.
- Molecular diffusivity: diffusion of dissolved particles.
- Electrical resistivity: electrical charge/current.
- Thermal conductivity: transport of thermal energy.

Color-coded visualization of transport phenomena, left: pressure, right: stream line view
VGStudio MAX has been supporting the import of CAD data for quite some time now. In the basic version of the software, the neutral exchange formats STEP and IGES can be directly imported and used for nominal/actual comparisons, segmentation and other tasks. Two add-on modules now open VGStudio MAX even further towards the CAD world.

**CAD IMPORT**

The new add-on module CAD Import allows you to load CATIA V5 and Creo/Pro/ENGINEER models. In addition, various other formats are available in beta status.*

**CAD IMPORT WITH PMI**

The new add-on module CAD Import with PMI** packs even more functionality for cleverly reusing information included in CAD files. It has been especially developed for process optimization in quality control and automatically translates and intelligently evaluates so-called PMI data. This ‘Product Manufacturing Information’ can be generated in many current CAD systems and provide additional part information (e.g., dimensioning, GD&T, layers, annotations, captions, etc.) with the CAD model – information that is of great use as long as it can be easily referenced to a CT data set.

Views defined on the CAD model can be automatically converted into VGStudio MAX bookmarks for quick orientation even in complex models. Utilizing the CAD Import with PMI module, you will be able to save a considerable amount of time in preparing your measurement plans and thus increase efficiency for your quality control.

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* Supported CAD formats are: CATIA V5 (R4 to V5-6R2013), Creo (Elements/Pro 5.0, Parametric 2.0). In beta status: CATIA V4 (up to 4.2.5), JT (up to 9.5), Pro/ENGINEER (up to Wildfire 5), Siemens PLM Software NX (Unigraphics V11.0 to NX 8.5), Solid Edge (V19 – 20), ST – ST6), SolidWorks (up to 2014).

** PMI import is supported for CATIA V5 and Creo. In beta status also for Pro/ENGINEER and Siemens PLM Software NX.
COORDINATE MEASUREMENT MODULE

VGStudio MAX turns your industrial CT scanner into a high-performance and precise Coordinate Measurement System. This software add-on allows for inspection tasks to be performed which cannot efficiently be accomplished when using conventional destructive or other non-destructive testing methods. The Coordinate Measurement Module was developed especially for use on CT data and provides a highly efficient and intuitive user interface in translating measurement plans onto the CT scan. In order to achieve the highest possible precision level for measurement, the Coordinate Measurement Module includes an advanced, local adaptive algorithm for precise surface determination with sub-voxel accuracy.

This functionality reduces measurement inaccuracies for all geometry-based analyses, i.e., for coordinate measurements, nominal/actual comparisons or for the analysis of wall thicknesses. The Coordinate Measurement Module is the prerequisite for all analyses to be performed within predefined coordinate systems. NEW To this end, version 3.0 will add even more object registration options and a significant improvement of the ‘Best fit’ algorithm.

Features:

- Includes a complete range of measuring functionality including geometric dimensioning and tolerancing (acc. to DIN EN ISO 1101).
- NEW The final release of version 3.0 will be submitted to a software test carried out by the Physikalisch-Technische Bundesanstalt/German National Metrology Laboratory (PTB), to verify the fulfillment of the functional requirements laid out by the PTB.
- 2D and 3D dimensioning directly on CT/voxel data sets.
- Ruled geometry elements such as points, lines, circles, planes, cylinders, cones and spheres can be fitted directly to the CT/voxel data – no conversion of CT data into point clouds or STL models required.
- Minimization/reduction of measurement uncertainty by using thousands of automatically generated fit points.
- Recognized standard fitting methods (Chebyshev, Gauss) used in conventional coordinate measurement technology.
- Powerful reporting function with text and images for output in various formats (CSV, HTML, RTF, PDF, etc.).
- Preparatory inspection plans can be created on CAD data, mesh data (STL) or even on another CT scan.
- Components of CAD models can be used as starting contour for the (local) adaptive surface determination, especially in multi-material scenarios. This will lead to a significant decrease in time needed to generate precise surfaces.
- Easy definition of least/maximum material requirements within the GD&T functionality.
- Enhanced alignment techniques, e.g., 3-2-1 registration also allows for offsets and subsequent rotations to solve highly complex alignment tasks.
- Vector points can be imported or defined, for highly precise and reproducible generation of reference objects and RPS alignments.

FOR QUANTITATIVE ANALYSES

Easily apply a conventional measurement plan to your voxel data.
NOMINAL/ACTUAL COMPARISON MODULE
REQUIRES COORDINATE MEASUREMENT MODULE

The Nominal/Actual Comparison Module allows for a direct comparison of CT/voxel data with CAD or other CT/voxel data. Being able to directly compare the dimensions of a part within the software environment is much more efficient than any conventional method.

Features:

- Color-coded visualization of analysis results.
- Analysis of the entire object or of user-defined ‘Regions of Interest’.
- Geometric comparison directly on CT/voxel data sets — no conversion into point clouds or into an STL model required. This avoids additional measurement uncertainty and loss of information.
- Geometric comparison is possible on CAD data, mesh data (STL) and, of course, on voxel data (e.g., ‘good part’).
- Additional statistical evaluation features.
- High performance reporting function with text and images for output in different formats (CSV, HTML, RTF, PDF, etc.) and for automated inspection.
- Ability to tolerance the nominal/actual comparison with various parameters, e.g., deviation (minimum, maximum, cumulated).
- Annotations for local probing.

WALL THICKNESS ANALYSIS MODULE

With the Wall Thickness Analysis Module, areas with insufficient or excessive wall thickness or gap width can be automatically localized directly within the CT/voxel data set.

Features:

- Color-coded visualization of analysis results.
- Analysis of the entire object or of a user-defined ‘Region of Interest’.
- Direct processing of CT/voxel data — no conversion into point clouds or STL data required.
- No CAD model required.
- Additional statistical evaluation features.
- High performance reporting function with text and images for output in various formats (CSV, HTML, RTF, PDF, etc.) and for automated inspection.
- Wall thickness analysis is, of course, possible on the voxel data but can now also be applied to CAD and mesh data (STL).
- Ability to tolerance the wall thickness analysis with various parameters, e.g., thickness (minimum, maximum, mean, deviation).
- Annotations for local probing.

Note: If wall thickness analyses are to be evaluated with the highest possible precision and within a precisely defined coordinate system, the optional Coordinate Measurement Module is required.
The Porosity/Inclusion Analysis Module allows for the automatic detection of material discontinuities such as pores, holes, and inclusions. This functionality module within VGStudio MAX is used in a wide range of applications, e.g., in castings, in the production of plastic parts and for BGAs.

Features:

- Automatic and fast detection, analysis and visualization of defects.
- Detection of both pores and inclusions.
- Defect detection can be run on a complete data set or on user defined regions (ROIs).
- Color-coded visualization of the detected defects according to the defect volume.
- Calculation of various parameters for each defect (defect position, defect sphericity/compactness, defect size and geometry (volume, x-/y-/z-dimensions, projected area), gap to closest other defect, distance of each defect to a reference surface (CAD or actual surface of the part)).
- Statistical defect size analysis: overall percentage of porosity and defect volume histogram.
- High performance reporting function with text and images for output in various formats (CSV, HTML, RTF, PDF, etc.) and for automated inspection.

A data interface allows analysis results to be exported to and simulation results to be imported from MAGMASOFT®.

- A VGDefX defect detection algorithm, which allows the calculation of defects to be optimized based on different criteria.
- Improved detection of surface defects.
- Possibility to specify the minimum defect size as radius, diameter or defect volume.
- In-place data filtering for noise reduction.
- Allows for pre-machining tests using CAD data: If the CAD file of the machined part is available, VGStudio MAX can do virtual machining of the part and automatically calculate which pores will be inside or outside the machined part and which pores will be cut during machining. Each defect will be classified into inside, outside or cut.
- Ability to tolerance the defect analysis with various parameters, e.g., void volume (percent/absolute), maximal defect diameter/volume/projected size, maximal edge distance (cut/inside/outside).

NEW: Combined Analyses: e.g., perform a wall thickness analysis and then combine a porosity/inclusion analysis.

Note: If the calculation of the defects is to be carried out in a well defined coordinate system, the optional Coordinate Measurement Module is required.
ENHANCED POROSITY/INCLUSION ANALYSIS MODULE

In addition to 3D analyses of porosities and inclusions, the Enhanced Porosity/Inclusion Analysis Module also supports a non-destructive 2D defect analysis of castings, based directly on the CT slice images, according to VDG* specifications P 201 and NEW P 202 or VW 50097 and NEW VW 50093, respectively. These testing specifications define the requirements for examining the porosity of castings made of non-ferrous metals. With this add-on option, Volume Graphics introduces micrograph image analysis methods to industrial CT images with sub-voxel precision. This special tool has been officially approved for use by VW.

*Verein Deutscher Giessereifachleute/German Association of Foundry Specialists

Using VGStudio MAX for a porosity analysis according to P 201/P 202 offers an enormous savings potential. As an integrated non-destructive solution it eliminates the need for the time-consuming production of micrograph sections and the preparation of samples. The analysis set-up can be saved as a template which allows for a rapid and reproducible analysis of all parts to be performed without any user interference.
Fiber composite materials such as CFRP or GRP are playing a major role in modern product designs. This analysis module now provides a data analysis solution for all professionals working in this field of application. The Fiber Composite Material Analysis Module enables users to process both small and large scale CT data sets of fiber composite materials. In small dimension material samples, CT data will be able to show individual fibers, large scale CT data sets will only show larger structures like rovings in sections of parts or complete parts. Depending on the user’s demands and the scale of the CT scan, the module is able to provide much sought after and detailed information of the internal structure of a part.

The following parameters can be calculated:

- Local fiber orientation
- Local fiber concentration
- Global fiber orientation distribution
- Global fiber concentration
- NEW Fiber length distribution
- Other statistical parameters

The analysis results can be displayed and reported in various ways, for example:

- Local fiber orientation can be displayed color-coded or as vectors, tensors and stream lines.
- Global orientation distribution can be displayed, e.g., as a histogram.
- Line plots of the individual components of the orientation tensor can be produced, in order to easily compare nominal and actual values.
- NEW For woven fabrics and rovings: display the main orientations for the weaving/rovings, e.g., for use in simulations.
- Reports can be generated and exported in a variety of formats (CSV, HTML, RTF, PDF, etc.).

The data set above was provided by Institut für Textil- und Verfahrenstechnik (ITV)
CT RECONSTRUCTION MODULE

With the CT Reconstruction Module, Volume Graphics offers a direct connection from the CT scanner to the unique analysis capabilities and visualization of VGStudio MAX. The module uses off-the-shelf PC and graphics hardware. Fully utilizing up-to-date GPU or multi-processor/multi-core systems, the CT Reconstruction Module reconstructs data sets of any size, limited only by the PC hardware. The user has the choice to optimize for image quality or performance.

Automatic scan geometry corrections

The CT Reconstruction Module offers a unique horizontal rotation center correction and an automatic axis tilt correction (in the detector plane). It is able to determine these corrections directly from the acquired data of the actual CT scan. Prescans of test phantoms are no longer required. These corrections increase the quality of CT data and are independent of the CT scanner.

Moreover, the CT Reconstruction Module is able to improve the image quality using the standard Volume Graphics beam hardening correction or the optional Iterative Artifact Reduction (IAR)* add-on.

Features:

- Unsurpassed reconstruction image quality leading to maximum precision in data analysis and measurement tasks.
- Unique interactive reconstruction preview.
- **NEW** Multi GPU support.
- Ultra-fast GPU accelerated reconstruction for CT users and CT system manufacturers.
- Cone beam, fan beam, parallel beam, planar and helical CT.
- Numerous automatic scan geometry corrections.
- Beam hardening correction, optional Iterative Artifact Reduction (IAR)* correction.
- Artifact-free ROI reconstruction.
- **NEW** Iterative (ART) reconstruction mode for FDK, spiral, planar scan geometries.
- **NEW** Metal artifact reduction.
- Offset scan reconstruction.
- VG project creation.
- Performance mode optimizes reconstruction time of very large data sets.

* Technology licensed by Fraunhofer EZRT

For highest performance needs, VG’s CT Reconstruction Module now comes with OpenCL multi GPU support.
Volume Graphics GmbH now has subsidiaries in Japan and the US. To broaden our global footprint even more, we can rely on a worldwide network of distributors. Numerous renowned local resellers supply their customers with our products and all major manufacturers of industrial CT equipment worldwide combine Volume Graphics software products with their CT systems.

Our additional services:

- Support for customers in using our software products and for analyzing their CT data.
- Standard training courses for beginners and advanced users, customized training, workshops and partner certification.
- Consulting services in all aspects of industrial computed tomography.
- Custom development projects: implementation of customer-specific requirements in the fields of visualization, analysis and processing of volumetric data.

Visit our website to learn more about our support and training opportunities as well as custom software development and consulting services.