



2018 Global Industrial  
Computed Tomography Software  
Market Leadership Award



2018  
**BEST PRACTICES**  
AWARDS

## Contents

Background and Company Performance .....	3
<i>Industry Challenges</i> .....	3
<i>Market Leadership of Volume Graphics</i> .....	3
<i>Conclusion</i> .....	7
Significance of Market Leadership.....	8
Understanding Market Leadership.....	8
Key Performance Criteria .....	9
Best Practices Recognition: 10 Steps to Researching, Identifying, and Recognizing Best Practices .....	10
The Intersection between 360-Degree Research and Best Practices Awards.....	11
<i>Research Methodology</i> .....	11
About Frost & Sullivan .....	12

## Background and Company Performance

### *Industry Challenges*

Globally, when compared to the uptake of coordinate measuring machines (CMMs), computed tomography (CT) metrology remains in a nascent stage of market adoption. High costs and technical limitations restrict its adoption. Technical challenges that impede ensuring data accuracy and a superior scanning speed, automated workflow, and multi-material complexity support weaken the demand for CT metrology systems.

Nevertheless, demand for three-dimensional (3D) metrology and structure analysis is growing fast due to the increasing need for acquiring the inner and outer geometry of parts without destroying them. As a result, the industry needs high-end software visualization and reconstruction of industrial 3D CT data that can combine advanced automation of data acquisition and volume processing with great accuracy and precision in a more reputable fashion, a major prerequisite for production lines including small and large production series. Most end users are demanding more efficient 3D production process control for industrial CT data analysis to prevent part failures, eliminate geometry deviations, and maximize correction tasks. Moreover, demand is increasing for a fully digital workflow featuring automated inspection of parts with a simplified visualization and inspection process for identifying parts, initiating the CT scanning process, quickly acquiring data, and verifying results and metrology of complex inner and outer structures. Moreover, despite technological advances in scanning at much higher speeds, the reconstruction of images is impacted by scatter artifacts. This creates a need for image quality enhancement.

Without an integrated digital inspection plan and precise data visualization solution, existing approaches remain disconnected. As such, there is need for advanced geometry processing software to easily share data with existing supply chain, research and development (R&D), pre-production, and production workflows that will support all interfaces for data exchange and inspection plans. Essentially, customers are looking for existing inspection data to become fully automated, flexible, customizable, and integrated into the inspection workflow. In response, industry participants need to surmount the technical challenges currently blocking the path towards revolutionizing the dimensional metrology space and thereby unleash the technology's market adoption potential.

### *Market Leadership of Volume Graphics*

#### **Growth Strategy Excellence**

To address customers' key unmet requirements in the current industrial CT market, Volume Graphics, a leading developer of software solutions with decades of experience, offers a portfolio of high-end software for CT data analysis and visualization. Volume Graphics enjoys a prominent position in the global software for industrial CT market,

capitalizing on its extensive precise and reliable product portfolio that delivers a wide range of data analysis and visualization solutions, including VGSTUDIO MAX, VGMETROLOGY, VGINLINE, and myVGL. In April 2018, the company released its new software version 3.2. With the new version users can easily correct, eliminate geometry deviations, and adjust inspection plans in production. In other words, 3.2 provide users with one single digital workflow combining design, production, inspection, and correction tools. Unlike many competing products, there is no need to add repetitive analysis and iterations on other tools to accelerate time to market. Moreover, users can easily correct geometry deviation of parts from the target model to reduce potential part failures. This capability allows users to enhance the geometry of 3D printed parts.

The company has made significant strides for the industry in advancing non-destructive testing (NDT) and quality control, making the technology more accurate and accessible to a wider scope of customers. Over the years, for instance, Volume Graphics has sustained its market growth and industry leadership by providing an innovative software module for the location and analysis of pores, holes, and inclusions within scanned parts that visualizes results and calculations in 3D, a coordinate measurement tool with a proven accuracy by the Physikalisch-Technische Bundesanstalt (PTB), Germany's national metrology institute, as well as a tool for performing virtual stress tests on scanned parts. The company has developed and continually evolves its high-end software solution portfolio that empowers customers to quickly and easily obtain results in their analysis of products in R&D, production, and quality assurance.

## **Brand Strength**

Frost & Sullivan's benchmarking analysis finds that Volume Graphics' success in the high-end industrial software CT market is largely driven by its effective implementation of superior end-user-centric strategies. Volume Graphics remains a leading provider of industrial CT software solutions and is highly regarded among manufacturers of industrial CT equipment, holding a market share of about 80% in 2017. Specifically, the company has achieved high market penetration in casting applications for porosity analysis and structure characterization in the automotive and aerospace & defense industries, which are the top markets (52% and 25%, respectively) for CT in dimensional metrology.

Frost & Sullivan concludes that the strong brand loyalty enjoyed by Volume Graphics derives from its proven know-how and capability to support customers across its robust original equipment manufacturer (OEM) network. With over 20 years of experience well-established in CT scan post processing, Volume Graphics ensures the most comprehensive set of application support in the entire industry, from reconstruction of 3D geometry and internal inspection of the part's structure through flaw discovery, metrology, and reverse engineering. While many competitors are offering fixed capabilities, Volume Graphics ensures provision of the highest flexibility and modularity in its existing offerings so users can add capability as needed to do more with their data. The company offers additional modules that then step into more advanced developments and analyses including fiber fill

and alignment analysis for filled materials. A solid reputation for establishing a thorough understanding of end users' needs indeed solidifies the company's superior brand equity.

### **Product Differentiation**

Striving to take CT technology to the next level of data analysis, Volume Graphics has introduced numerous projection capabilities to reconstruct all geometric information, eliminate geometry deviations, and maximize correction tasks. With the new version of VGSTUDIO MAX, VGSTUDIO, VGinLINE, and VGMETROLOGY, users can now perform corrections by identifying geometry deviations of parts in comparison to the nominal computer-aided design (CAD) geometry. For example, the company's recent Manufacturing Geometry Correction Module provides color-coded visualization so customers can easily and automatically identify any manufactured part deviation, including undercuts. This unique proposition distinguishes Volume Graphics from other leading participants in the industry and enables users to improve the precision of failure analysis as well as easily compare 3D CAD models with the acquired information. Users can conduct CT scans and analysis of dimensions that are out of tolerance based on the setting rules in advance. In addition, the software portfolio works with voxel, .stl, and CAD data. Demonstrating its unique ability to appropriately meet such market needs, Volume Graphics has made significant contributions to delivering optimized defect analysis with automated generation of reports.

### **Price/Performance Value**

Success for any company hinges on offering the best possible price-performance balance to customers. Volume Graphics' software solutions exhibit striking differentiation from conventional CT industrial software and can be used for almost all applications in research and production environments. Many of these initiatives lead to highly disruptive innovations. OEMs, particularly in the automotive and aerospace industries, appreciate the price-performance value offered by Volume Graphics' high-end software that improves inspection quality and productivity for industrial applications. Frost & Sullivan finds that no competing company can offer a superior price package for the automotive segment.

Typically, a standard Volume Graphics entry package is \$15K to \$25K for general CT software. The entry package covers dimensional metrology requirements. Users can tailor the software to specific needs with more advanced add-on modules and bundles for broad areas of applications in the range of \$30K to \$40K. Each standard software and all additional modules are offered in 6 languages including English, German, French, Japanese, Chinese, and Korean. The company also offers an optional agreement for one full year to get access to regular software updates and priority support. Typically, software packages are offered under node-locked, floating, or dongle licenses. VGSTUDIO, VGSTUDIO MAX, and VGMETROLOGY are offered under a node-locked license for the usage on one specific computer. For customers who require use across a wide range of computers, the company is offering a floating license for use of the same software package on several computers and

different operating systems with a wide range of networks. According to the company, a dongle license protection is also offered without any additional charge for users that have an update agreement. Moreover, the company is offering free evaluation versions of its software.

The top two competitors' options are limited as compared to Volume Graphics' offerings, which also guarantee no hidden costs applicable later. This is significant because predictable and transparent price packages are becoming accepted for industrial software CT offerings, and Volume Graphics is exemplifying this practice.

### **Customer Purchase Experience**

Volume Graphics works diligently to sustain its leadership position for applications in key vertical markets such as automotive and aerospace. Historically, the company has catered to these industries, particularly addressing their requirements around the use of CT scanning in the manufacturing space. Committed to providing its customers with an enhanced purchase experience through the life span of its CT products, Volume Graphics has leveraged a proven technology to design a wide range of product packages and modules, from simple reconstruction of 3D geometry and flaw detection to reverse engineering. The company offers, for example, a software package for a fully automated digital workflow that minimizes the operator time and risk of error with a high repeatability of results, unrivaled precision, and consistent reliability. According to the company, data files, analysis results, and reports can be recalled at any point in the future. All CT processes including reconstruction and evaluation analysis of failures can be fully programmed and performed automatically using Volume Graphics' software.

Essentially, Volume Graphics ensures a simplified workflow with significant flexible and traceable value addition. This is best demonstrated in the ease of use guaranteed by the solutions' processing feature that ensures traceability of all inspection data, a strong focus on task execution, decisions for rapid data acquisition and high scanning speed, 3D analyses, and automatic defect detection algorithms for both NDT and metrology.

Volume Graphics offers a highly customizable and improved user interface for automatic defect recognition, 3D visualization, and analysis of complex inner geometries, which is extremely useful for serial inspection and production control processes. In fact, at any step of the process, users can access the data set as well as all the analyses that have been performed so far.

Moreover, users want to keep all of their metrology data in one environment; therefore, Volume Graphics Software can process data sets not only from CT scanners but also from optical scanners. In fact, some users deploy Volume Graphics software in other technical fields, so now they can rely on the same software for use with other hardware technologies.

## *Conclusion*

Volume Graphics has made significant progress in delivering advanced modes of analyzing data from industrial CT systems. As technology evolves, high-end industrial CT software is expected to provide manufacturers not only a means of inspection, but also with valuable insights into the production process. Volume Graphics has consolidated its market leadership with the launch of its software version 3.2 in April of 2018. The new version provides users with a single digital workflow combining design, production, inspection, and correction tools. This workflow ultimately speeds up time to market and eliminates errors at an unprecedented level. For its strong overall performance, Volume Graphics has earned Frost & Sullivan's 2018 Market Leadership award for its singular contributions toward consistently advancing the CT systems market.

## Significance of Market Leadership

Ultimately, growth in any organization depends upon customers purchasing from a company, and then making the decision to return time and again. Loyal customers become brand advocates; brand advocates recruit new customers; the company grows; and then it attains market leadership. To achieve and maintain market leadership, an organization must strive to be best-in-class in three key areas: understanding demand, nurturing the brand, and differentiating from the competition.



## Understanding Market Leadership

Driving demand, strengthening the brand, and differentiating from the competition all play a critical role in a company's path to market leadership. This three-fold focus, however, is only the beginning of the journey and must be complemented by an equally rigorous focus on the customer experience. Best-practice organizations, therefore, commit to the customer at each stage of the buying cycle and continue to nurture the relationship once the customer has made a purchase. In this way, they build a loyal, ever-growing customer base and methodically add to their market share over time.

## Key Performance Criteria

For the Market Leadership Award, Frost & Sullivan Analysts focused on specific criteria to determine the areas of performance excellence that led to the company's leadership position. The criteria considered include (although not limited to) the following:

Criterion	Requirement
<b>Growth Strategy Excellence</b>	Demonstrated ability to consistently identify, prioritize, and pursue emerging growth opportunities
Implementation Excellence	Processes support the efficient and consistent implementation of tactics designed to support the strategy
<b>Brand Strength</b>	The possession of a brand that is respected, recognized, and remembered
Product Quality	The product or service receives high marks for performance, functionality, and reliability at every stage of the life cycle
<b>Product Differentiation</b>	The product or service has carved out a market niche, whether based on price, quality, or uniqueness of offering (or some combination of the three) that another company cannot easily duplicate
Technology Leverage	Demonstrated commitment to incorporating leading-edge technologies into product offerings, for greater product performance and value
<b>Price/Performance Value</b>	Products or services offer the best value for the price, compared to similar offerings in the market
Customer Purchase Experience	Customers feel they are buying the most optimal solution that addresses both their unique needs and their unique constraints
<b>Customer Ownership Experience</b>	Customers are proud to own the company's product or service, and have a positive experience throughout the life of the product or service
Customer Service Experience	Customer service is accessible, fast, stress-free, and of high quality

## Best Practices Recognition: 10 Steps to Researching, Identifying, and Recognizing Best Practices

Frost & Sullivan Awards follow a 10-step process to evaluate Award candidates and assess their fit with best practice criteria. The reputation and integrity of the Awards are based on close adherence to this process.

STEP	OBJECTIVE	KEY ACTIVITIES	OUTPUT
1 <b>Monitor, target, and screen</b>	Identify Award recipient candidates from around the globe	<ul style="list-style-type: none"> <li>Conduct in-depth industry research</li> <li>Identify emerging sectors</li> <li>Scan multiple geographies</li> </ul>	Pipeline of candidates who potentially meet all best-practice criteria
2 <b>Perform 360-degree research</b>	Perform comprehensive, 360-degree research on all candidates in the pipeline	<ul style="list-style-type: none"> <li>Interview thought leaders and industry practitioners</li> <li>Assess candidates' fit with best-practice criteria</li> <li>Rank all candidates</li> </ul>	Matrix positioning of all candidates' performance relative to one another
3 <b>Invite thought leadership in best practices</b>	Perform in-depth examination of all candidates	<ul style="list-style-type: none"> <li>Confirm best-practice criteria</li> <li>Examine eligibility of all candidates</li> <li>Identify any information gaps</li> </ul>	Detailed profiles of all ranked candidates
4 <b>Initiate research director review</b>	Conduct an unbiased evaluation of all candidate profiles	<ul style="list-style-type: none"> <li>Brainstorm ranking options</li> <li>Invite multiple perspectives on candidates' performance</li> <li>Update candidate profiles</li> </ul>	Final prioritization of all eligible candidates and companion best-practice positioning paper
5 <b>Assemble panel of industry experts</b>	Present findings to an expert panel of industry thought leaders	<ul style="list-style-type: none"> <li>Share findings</li> <li>Strengthen cases for candidate eligibility</li> <li>Prioritize candidates</li> </ul>	Refined list of prioritized Award candidates
6 <b>Conduct global industry review</b>	Build consensus on Award candidates' eligibility	<ul style="list-style-type: none"> <li>Hold global team meeting to review all candidates</li> <li>Pressure-test fit with criteria</li> <li>Confirm inclusion of all eligible candidates</li> </ul>	Final list of eligible Award candidates, representing success stories worldwide
7 <b>Perform quality check</b>	Develop official Award consideration materials	<ul style="list-style-type: none"> <li>Perform final performance benchmarking activities</li> <li>Write nominations</li> <li>Perform quality review</li> </ul>	High-quality, accurate, and creative presentation of nominees' successes
8 <b>Reconnect with panel of industry experts</b>	Finalize the selection of the best-practice Award recipient	<ul style="list-style-type: none"> <li>Review analysis with panel</li> <li>Build consensus</li> <li>Select recipient</li> </ul>	Decision on which company performs best against all best-practice criteria

STEP	OBJECTIVE	KEY ACTIVITIES	OUTPUT
9 <b>Communicate recognition</b>	Inform Award recipient of Award recognition	<ul style="list-style-type: none"> <li>Present Award to the CEO</li> <li>Inspire the organization for continued success</li> <li>Celebrate the recipient's performance</li> </ul>	Announcement of Award and plan for how recipient can use the Award to enhance the brand
10 <b>Take strategic action</b>	Upon licensing, company is able to share Award news with stakeholders and customers	<ul style="list-style-type: none"> <li>Coordinate media outreach</li> <li>Design a marketing plan</li> <li>Assess Award's role in future strategic planning</li> </ul>	Widespread awareness of recipient's Award status among investors, media personnel, and employees

## The Intersection between 360-Degree Research and Best Practices Awards

### Research Methodology

Frost & Sullivan's 360-degree research methodology represents the analytical rigor of our research process. It offers a 360-degree-view of industry challenges, trends, and issues by integrating all 7 of Frost & Sullivan's research methodologies. Too often companies make important growth decisions based on a narrow understanding of their environment, leading to errors of both omission and commission. Successful growth strategies are founded on a thorough understanding of market, technical, economic, financial, customer, best practices, and demographic analyses. The integration of these research disciplines into the 360-degree research methodology provides an evaluation platform for benchmarking industry participants and for identifying those performing at best-in-class levels.

360-DEGREE RESEARCH: SEEING ORDER IN THE CHAOS



## About Frost & Sullivan

Frost & Sullivan, the Growth Partnership Company, enables clients to accelerate growth and achieve best-in-class positions in growth, innovation and leadership. The company's Growth Partnership Service provides the CEO and the CEO's Growth Team with disciplined research and best practice models to drive the generation, evaluation and implementation of powerful growth strategies. Frost & Sullivan leverages more than 50 years of experience in partnering with Global 1000 companies, emerging businesses, and the investment community from 45 offices on six continents. To join our Growth Partnership, please visit <http://www.frost.com>.