thermo scientific

Avizo Software for Industrial Inspection

Digital inspection and materials analysis

ThermoFisher SCIENTIFIC

Thermo Scientific™ Avizo™ Software provides a comprehensive set of tools addressing the whole research-to-production cycle: from materials research in off-line labs to automated quality control in production environments.

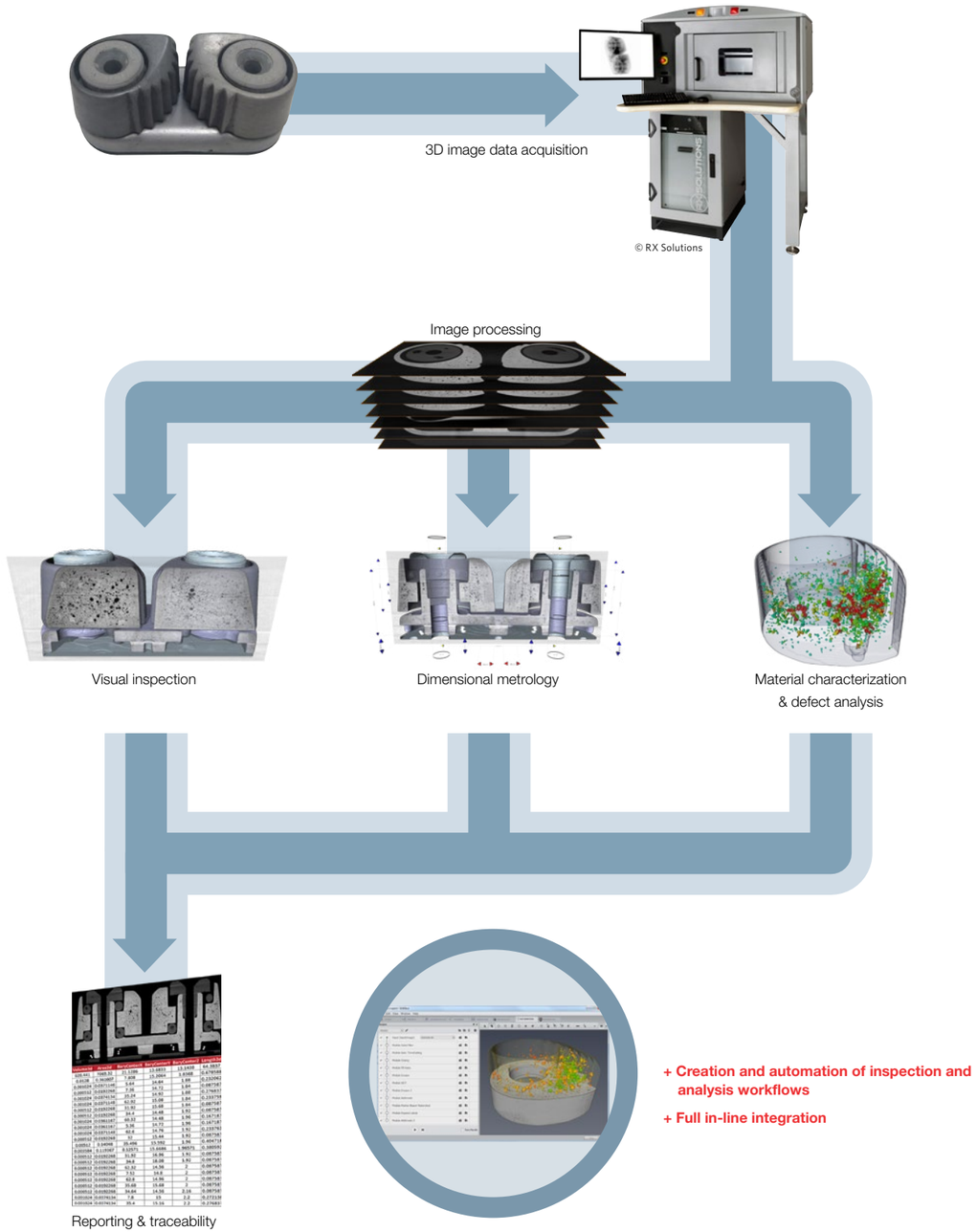
Whatever the part or material you need to inspect, using X-ray CT, radiography, or microscopy, Avizo Software is the solution of choice for materials characterization and defect detection in a wide range of areas (additive manufacturing, aerospace, automotive, casting, electronics, food, manufacturing) and for many types of materials (fibrous, porous, metals and alloys, ceramics, composites and polymers).

Avizo Software also provides dimensional metrology with advanced measurements; an extensive set of programmable automated analysis workflows (recipes); reporting and traceability; actual/nominal comparison by integrating CAD models; and a fully automated in-line inspection framework.

With Avizo Software, reduce your design cycle, inspection times, and meet higher-level quality standards at a lower cost.

On the cover: Porosity analysis and dimensional metrology on compressor housing.
Data courtesy of CyXplus

Digital workflow



Avizo Software for Industrial Inspection

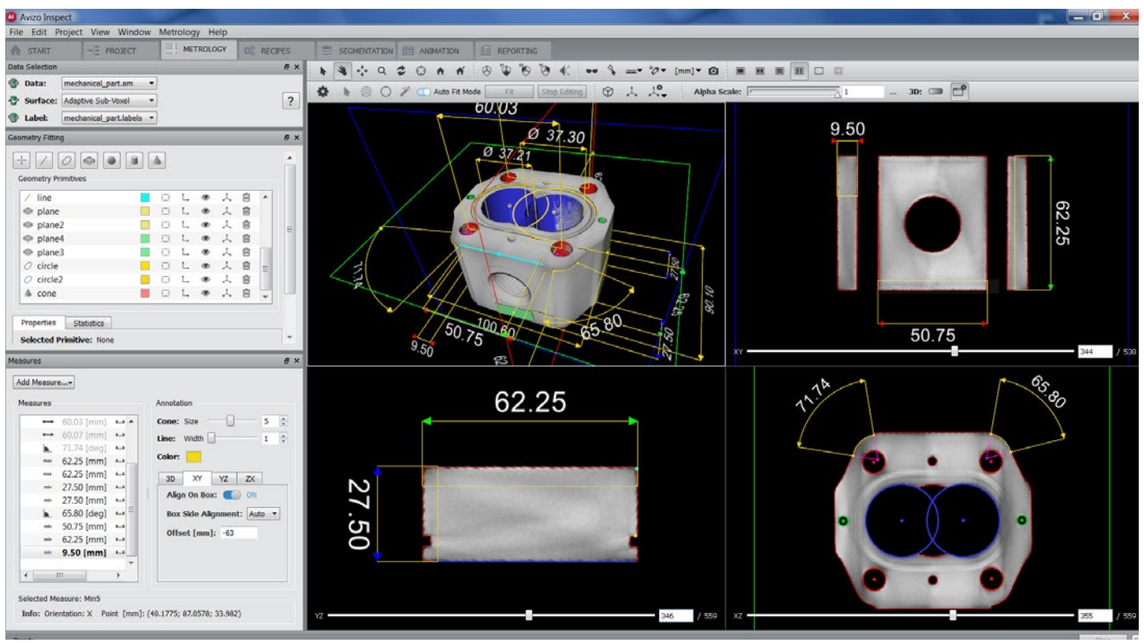
Learn more at **thermofisher.com/amira-avizo**

Integrating expertise acquired over more than 10 years and developed in collaboration with major industrial partners in the aerospace, automotive, and consumer goods industries, Avizo Software allows to visualize, analyze, measure and inspect parts and materials.

Dimensional metrology

The Avizo Metrology workroom supports advanced measurements of parts. The dimensioning process starts with the definition of an orientation or multiple orientations for the part, which can be used for defining the direction for future measurements and for visualization of the part. This orientation process is based on geometrical shapes that are fitted and later used in performing measurements, such as distance, angle, and diameter/radius; or tolerancing measurements, such as parallelism or perpendicularity. Each of the measures can be assigned a nominal value and a tolerance will be validated according to these parameters.

Avizo Software achieves sub-resolution precision in its measurements. Most importantly, Avizo Software includes an advanced algorithm to accurately determine the surface location when defining the boundary of the part. Avizo Software includes unique algorithms implemented in collaboration with leading research laboratories in order to provide the best estimation of the interface between material and non-material. Geometric fitting and measurement precision is based primarily on the ability to extract the most accurate surface location.



Porosity analysis

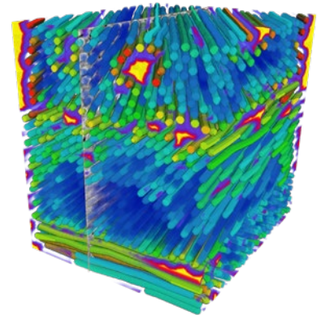
Imaging techniques such as CT, FIB-SEM, SEM, and TEM, allow detection of structural defects in the interior of a part or a material. Avizo Software includes advanced detection, quantification and classification modules for defect detection and pore analysis that can discover and measure voids, inclusions, and closed or open pores. Results of the quantification process permit characterization of pore shape, pore distribution, distance from pore to surface, distance to neighbors, clustering of pores and pore connectivity. Porosity can be turned into a model (Pore Network Model), allowing for rapid understanding and exploration of the pore space, including absolute permeability calculation.

Porosity analysis on compressor housing. Data courtesy of CyXplus

Fiber analysis

Fibrous materials, such as carbon or glass fiber (CFRP, GFRP), fabric (multi-layer composites), fiber-reinforced concrete (FRC), or organic fibers, are used in a wide range of applications and industries.

Avizo Software provides tools that allow measurements such as length and orientation of fibers and analysis of those materials; for example, to detect manufacturing imperfections or to quantify microstructures to obtain insights on mechanical properties (strength, stiffness, etc.). Avizo Software enables the detection of manufacturing process damage such as matrix cracking, fiber/matrix debonding, or fiber breakage.



Defect analysis of a CFRP bike frame. Data courtesy of Rigaku Corporation

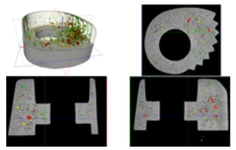
Actual/nominal comparison by integrating CAD models

Avizo Software supports the comparison of a 3D image (CT or other) with a corresponding CAD model. CAD models from all major vendors can be imported and registered to the 3D image, and the deviation between the model and the 3D image can then be computed.

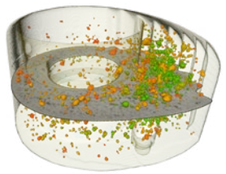
Creation and automation of inspection and analysis workflows

Avizo Software has been designed as an open framework, where “recipes” can be created, customized, and tuned to accommodate part configuration, material properties and characteristics of the acquisition system, thereby achieving the most accurate measurements. Users can create their own recipes and integrate their own expertise and proprietary knowledge into the Avizo Software open framework. Simply reapplying the recipes to a set of parts or materials can fully automate the measurement process.

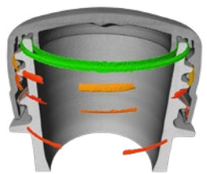
Avizo Software comes with a collection of recipes, and our experts can work with you to create specially-customized recipes for a particular inspection process or analysis.



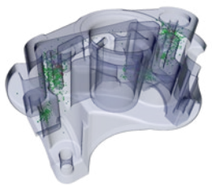
Measure of minimum distance between defects



Measure of defect distance to surface of the part



Multi-parts contact areas

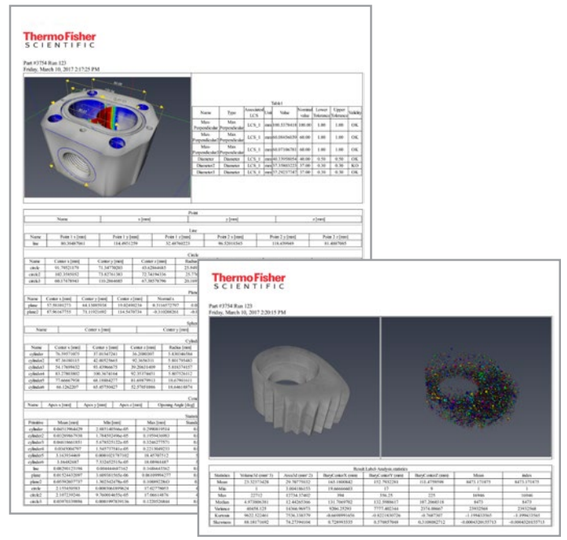


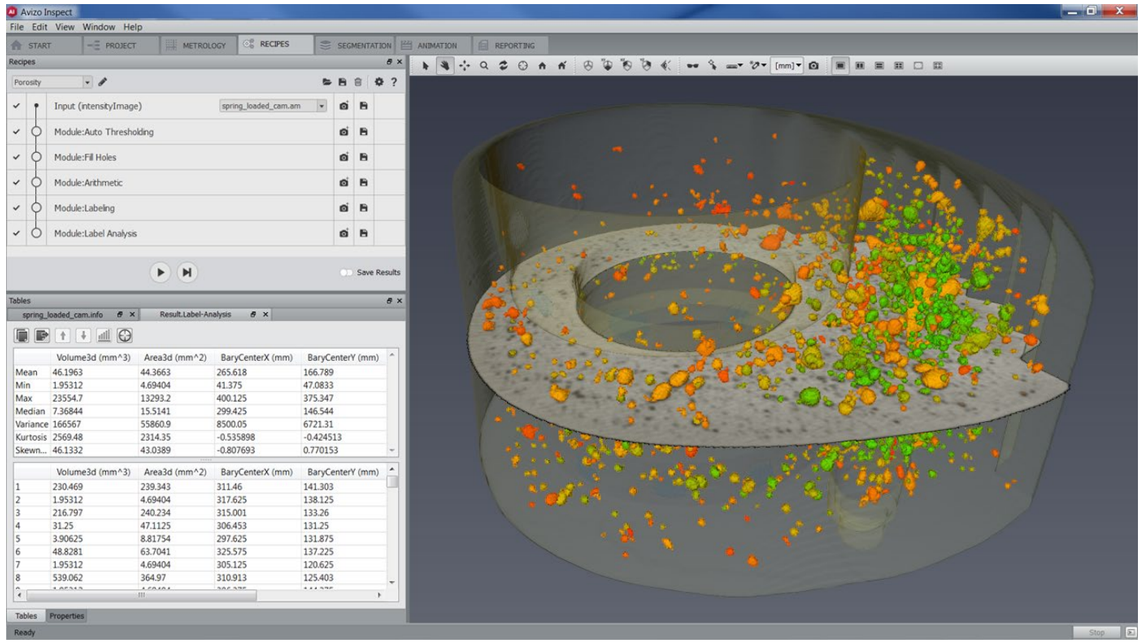
Defect prediction before machining

Reporting & traceability

Avizo Software includes a reporting workroom that allows the user to populate a template report with analysis results coming from the execution of a recipe or performance of measurements. This permits efficient delivery, sharing, and archiving of documented results in HTML or PDF format.

The templates are easily created or customized and automatically or manually populated and archived. Snapshots and spreadsheets can be exported to the reporting workroom. A history log containing the metadata for each result is also created, making it possible to trace the entire life cycle of the data.





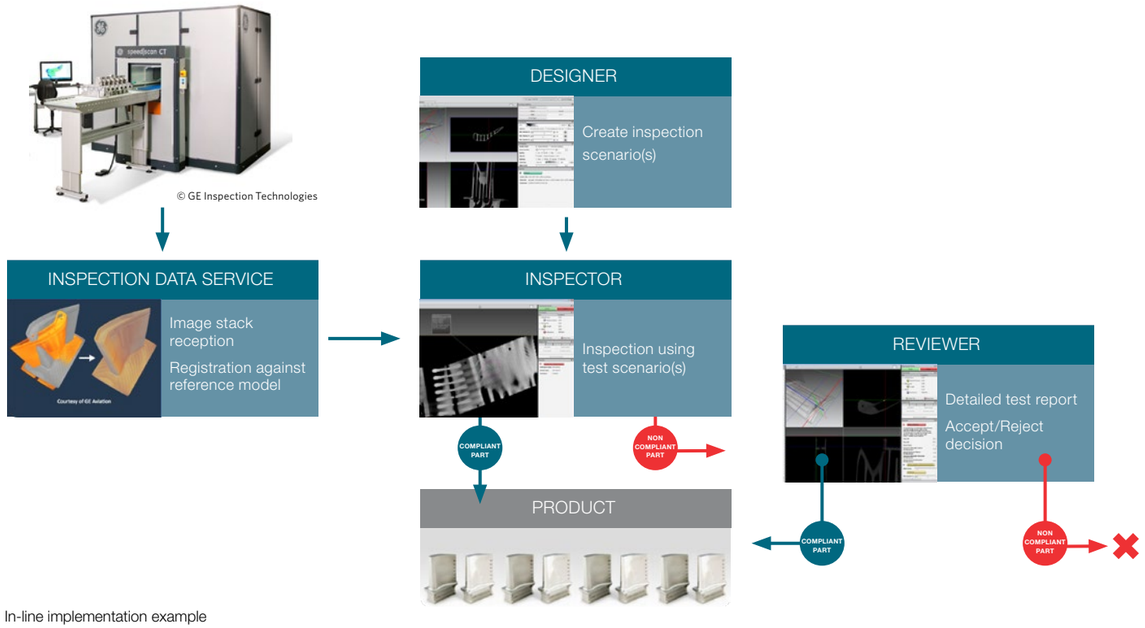
Example of custom recipe. Data courtesy of RX Solutions

Full in-line integration

Complex inspection scenarios, combining multiple recipes on different sub-regions of the part or material, can be created using Avizo Designer. Scenarios can combine multiple steps of visual inspection and automatic or manual measurements.

Inspector services run scenarios created with Avizo Designer software and will accept or reject a part according to automated or interactive acceptance and/or tolerance values associated with automatic and/or manual measurements.

Avizo Software In-line directly connects Inspector services with the acquisition system, streamlining the inspection process. Avizo Service, included with In-line, pre-processes data pushed to a DICOM/DICONDE server; performs pre-processing, such as multi-part splitting, part registration to reference model, and acquisition artifact reduction; then dispatches the pre-processed part to a scalable collection of Inspector services. At any time, the results of inspection scenarios can be accessed with Reviewer services, where each step of the scenario can be reviewed and a final decision on part acceptance made. Avizo In-line also includes user administration, allowing assignment and management of different permission levels.



In-line implementation example

Key features

Import and process

- Handle any modality, at any scale, of any size:
  - X-ray tomography: CT, micro-/nano-CT, synchrotron
  - Microscopy: electron and optical
  - Other acquisition techniques (MRI, radiography, etc.)
- CAD data import (STEP, IGES, CATIA, JT, SolidWorks™, Unigraphics, Autocad Dwg, ParaSolid, etc.)
- Support for multi-data/multi-view, multi-channel, time series, very large data
- Scaling, calibration, conversion, re-sampling
- Image enhancement, comprehensive filtering and convolution, Fourier frequency transforms
- Artifact reduction algorithms
- Advanced multi-mode 2D/3D automatic registration
- Image stack alignment, arithmetic, correlation, fusion

Visualize and explore

- Interactive high-quality volume visualization
- Orthogonal, oblique, cylindrical, and curved slicing
- Contouring and iso-surface extraction
- Data features highlighted on-the-fly with image filtering (contrast control, histogram equalization, dynamic colormap and opacity on slices or volumes, etc.)

Segment

- Thresholding and auto-segmentation, object separation, automatic labeling
- Region growing, snakes, interpolation, wrapping, smoothing
- Morphological processing, including watershed and basins
- 3D surface reconstruction and tetrahedral grid generation
- Skeletonization

Measure

- Accurate surface extraction for sub-resolution precision
- Geometry fitting (point, line, plane, cylinder, sphere, cone)
- Measures (direct and secondary measures on data and fitted geometry)
- Automatic test plan creation and replay

Analyze and quantify

- Recipe creation, customization, automated replay
- History log of results
- Report generation
- Built-in measurements, including counts, volumes, areas, perimeters, aspect ratios, and orientations
- User-defined measures
- Results viewer with spreadsheet tool and charting
- Automatic individual feature measurements, 3D localization, and spreadsheet selection
- Automated statistics, distribution graphs
- Feature filtering using any measurement criterion
- Geometry registration, measurements and comparison
- Porosity detection and measurement
- Fiber analysis
- Pre-processing for structural and flow simulations

In-line

- Multiple acquisition systems
- Acquisition service
  - DICOM/DICONDE connection
  - Multi-part (pallet) split
  - Automatic registration to reference
  - Pre-processing
- Designer
  - Definition of inspection/analysis scenario
- Inspector
  - Manual or automated run of scenario
  - Acceptance/Rejection of part
- Reviewer
  - Final rejected part review

Present

- Video generation
- Advanced key frame and object animation
- Mix images, geometric models, measurements, and simulations
- Annotations, measures legends, histograms, and curve plots
- Export spreadsheets, 3D models, high-quality images

Simulate

Image-to-simulation workflows:

- 3D image-based meshing for Finite Element and CFD simulations, export to FEA/CFD solvers and advanced post-processing of simulation results
- Porosity/pore connectivity analysis and skeletonization for Pore Network Modeling
- Digital Volume Correlation: 3D internal displacement and strain measurements
- Direct 3D image-based simulation: absolute permeability, molecular diffusivity, electrical resistivity, and thermal conductivity computation

Access to a large range of ecosystems

- Python scripting API
- MATLAB™ bridge
- LabView bridge
- Custom C++ modules development

Professional services

We offer a comprehensive set of professional services. From training to consulting or custom development, our professional services experts are dedicated to helping you be the most productive with Avizo Software.

Training

Our custom training is designed to provide you with immediate and practical skills while keeping your specific goals in sight. We can help you quickly and effectively master all of Avizo Software's capabilities through focused training.

Various courses can be arranged with typical durations ranging from 1 to 3 days. We can customize our training to best fit your needs. The training can be arranged on-site at your location or may also be delivered at one of our facilities.

Consulting

Our experts will help you get the best out of the constant innovations introduced in Avizo Software so you can benefit from them in your daily work.

We are your partner in creating solutions using Avizo Software. Custom-made consulting sessions can be performed at your facilities or remotely, depending on your needs. Our consultants can help you analyze your specific tasks and workflows, and leverage your knowledge and specific expertise, to get them implemented in Avizo Software.

Custom development

With over 25 years of experience in 3D and image processing and hundreds of projects delivered to organizations small and large, we can provide you with a solution tailored to fit your specific needs.

We have the ability to customize and expand our software solutions at various levels, including but not limited to:

- Building simple push-button solutions from entire workflows
- Integrating specific algorithms
- Implementing our solutions into an existing process
- Creating support for custom file formats

Learn more at **thermofisher.com/amira-avizo**

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