

Industry 4.0

ARAMIS Optical Strain

Materials & Structural Testing
Strain & Displacements
Vibration & Impact



NextGen Testing for CAE Validation

Non-Contact, Full-Field Capability.

Save Labor, Costs and Schedule.

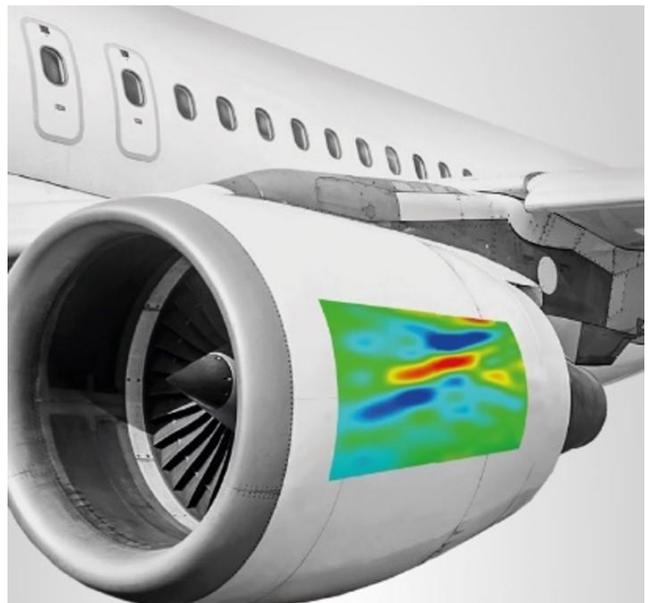
ARAMIS Optical Strain

ARAMIS Optical Strain, using Digital Image Correlation (3D-DIC) and Dynamic 3D Photogrammetry, is a transformational technology providing precision measurements of real, complex materials and structures. ARAMIS Optical Strain is the Industry 4.0 tool for R&D labs, manufacturing and structural test. These full-field optical strain and 3D displacements provide the critical data for accurate measurements and precise validation of computer models. Our goal is to provide our customers with cutting-edge capabilities with high measurement accuracy and highly efficient controls, and with the wraparound training and services to support them.

Design and manufactured in Germany for over 30 years, is ideal for measuring material behaviors dynamic structure response. It makes tens of thousands of measurement points yet requires a fraction of the set-up time of a single mechanical sensor, i.e. strain gage, extensometer or draw wire displacement sensor. ARAMIS Optical Strain provides a holistic understanding of components under test. Like a FEM (Finite Element Model), each measurement captures the entire measuring volume seen by the cameras, including your areas of concern; and especially the areas that you do not know are a concern, all are measured simultaneously.

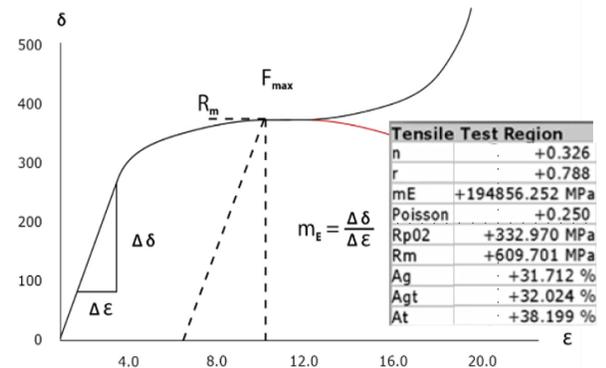
Advanced materials designs cause complex issues with load transfer and shear forces, which make full-field optical measurements critical.

ARAMIS 3D-DIC Photogrammetry makes Finite Element Measurements with 10,000 nodes in three axes of deformation, with 6-DOF (degrees of freedom), and the full strain tensor at every point. From materials to complex components to entire aircraft, this is the ideal tool for CAE model validation.



Material Testing

Material Properties are one of the most important parameters to understand in your advanced product design. Characterization of materials establishes the basis for your computer models and of all your process data. ARAMIS 3D-DIC is the ideal tool for measuring material properties. It is fully non-contact, full-field, and provides rapid, holistic understanding of the materials under test.



Class A Extensometer ARAMIS 3D-DIC can provide precision measurements, matching any clip gauge, strain gage or extensometer. ARAMIS is certified as ISO 9513 class 0.5 extensometer. Measurements provide thousands of data points in all three axes with the greatest accuracy for your material properties evaluation. 3D-DIC, being fully 3D, corrects for the measurement errors of laser and video extensometers, as well as 2D-DIC systems.



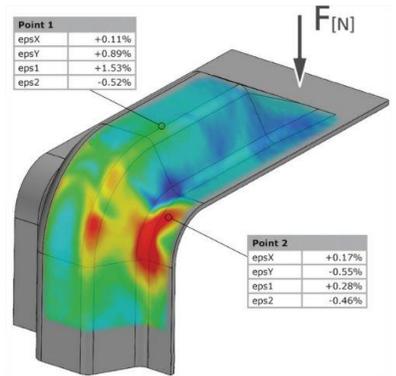
ASTM/ISO Standards automated templates allow you to automatically determine all your material properties, directly to Industry standards, simply and efficiently. Customers automate their materials properties measurements saving on time, effort, and schedule, reducing costs and getting substantially better, more consistent material data. (ref: NASA Glenn)



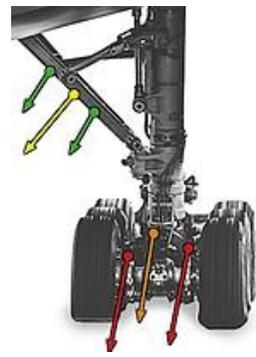
Test Machine Alignment validation is inherent with every ARAMIS measurement performed. Poor alignment of fixturing is critical for getting good data. ARAMIS confirms proper 3D alignment and loading with every test.

Component Testing

ARAMIS Optical Strain provides full-field component testing, measuring all points, not just the areas that you believe to be an issue; truly adding value to Finite Element Model validation measurements. Simulation experts say that ARAMIS provides them the true response of the structural loading, critical for understanding complex structures.

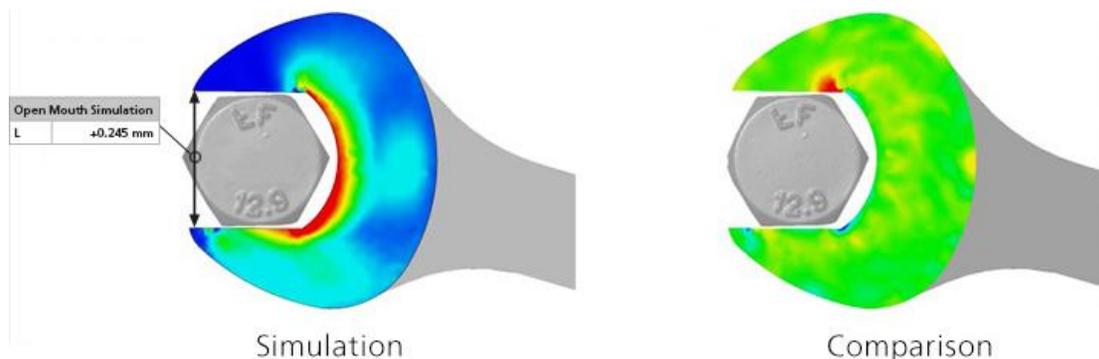


ARAMIS 3D Photogrammetry dynamically tracks individual target dots and captures 6-DOF (Degrees of Freedom), at highest accuracy the dynamic 3D displacements, and strains unlike traditional measurements. Typically engineers want more measurement points, ARAMIS gives them to you.



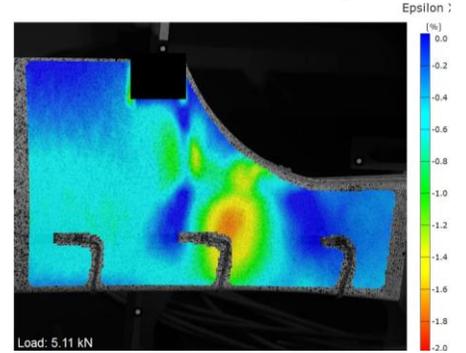
TRITOP CMM Photogrammetry system portably measures 3D coordinates of large complex objects precisely and provides automatic stitching for ARAMIS and ATOS. TRITOP is the perfect tool for a larger field of view such as entire vehicles, plants and civil structures.

ARAMIS FEA Validation becomes easy in the software, allowing CAD model import for precise measurement orientation to CAD coordinates. FEA simulation import to directly compare 3D displacements and strains, point-by-point, comparing the computer model with the real structural responses. Directly import models and automatically align to the 3D measurement data, allowing direct comparison to full-field measurements, for easy model optimization of boundary conditions.



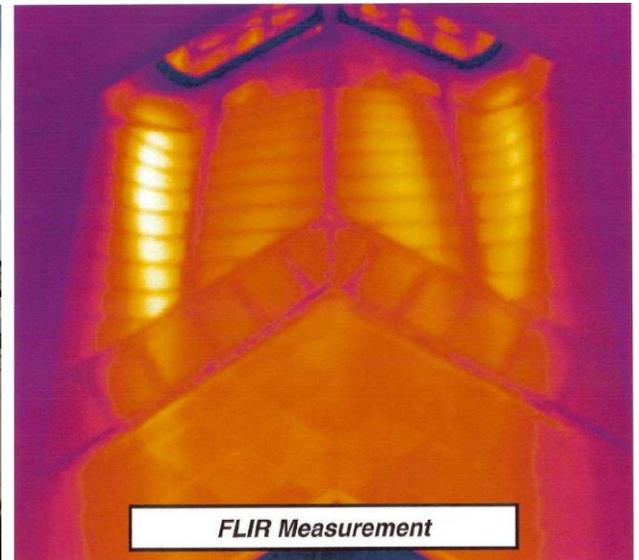
Structural Testing

Structural Testing is core to the power of ARAMIS, allowing you to holistically understand your structure's response. Currently, most structural testing uses ancient methods. CAE validation requirements, with the precision of their models, have grown to far exceed these capabilities. Companies like Boeing have shown that ARAMIS is 10x cheaper than traditional mechanical gages, 50x less labor, and provide 100x more data, critical for providing the measurements required to validate CAE models.



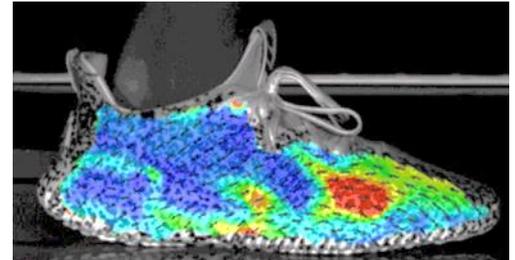
Strain in CAD Coordinates ARAMIS allows you to bring in the CAD coordinates, which aligns all in 3D measurements in deformation and strain precisely to your true CAD coordinates. ARAMIS can be placed a more accurately than traditional strain gage positioning.

ARAMIS Thermography is the key to precision strain measurement in red-hot environments, and for NDT (NonDestructive Testing), providing thermal data in precise 3D coordinates. The full-field 3D thermal data allows the ARAMIS strains to be corrected for thermal expansion, displaying true mechanical strains, as well as full-field temperature in CAD coordinates. Developed for thermal fatigue failure of B-2 Aft Deck, the technology is broadly used for materials, microelectronics, engines, dynamic events and vehicles .



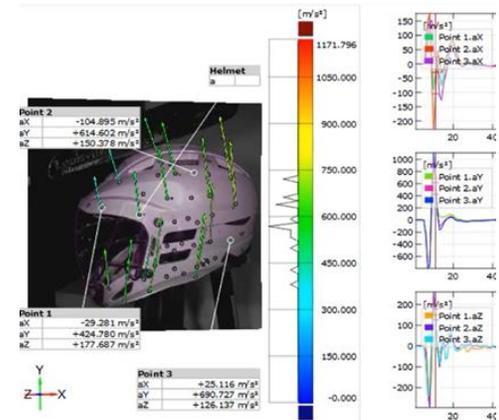
High-Speed

ARAMIS 3D High-Speed combines high-speed cameras with the power of the ARAMIS Optical Strain software to measure components at any speed, for high strain rate materials testing, vibration analysis and impact testing, from thousands to millions of frames per second (fps). Standard ARAMIS high-speed cameras run at 6Kfps and up to 50Kfps, while ultra-high-speed cameras, can go up to 5Mfps.

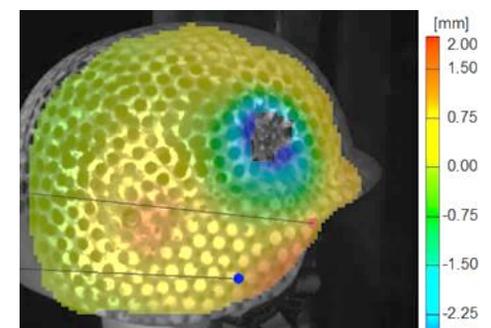


ISO Drop testing (1K-20K fps) helps consumer goods designers for reliability. Micro-electronics companies use ARAMIS Optical Strain to measure the dynamic behavior of dropped components (6 DOF, acceleration...) and its 3D deformation during impact, based on current standards.

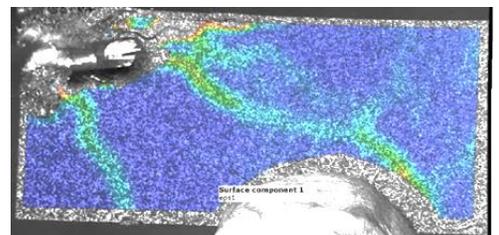
Impact & Crash testing (5K-50K fps) from automotive and aerospace crash tests, to sports helmets design requires data acquisition in thousands of fps. Full-field measurements of acceleration, displacement strains and buckling, ARAMIS High-Speed can generate meaningful data for engineers rapidly without installing any contact sensors.



Ballistic & Blast testing (20K-300K fps) has been an early adopter of high-speed imaging. The ARAMIS High-Speed system turns your high-speed cameras into 3D sensors, capable of measuring thousands of data points during highly dynamic events. This picture shows the dynamic response of a military helmet during ballistic impact.

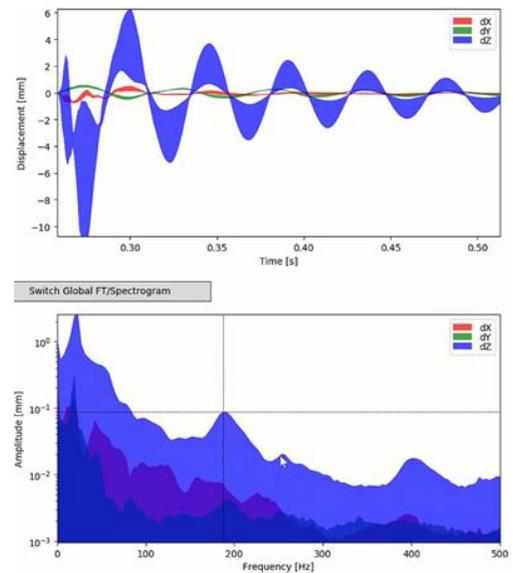


Shock & Brittle Fracture (100K-5M fps) including Split-Hopkinson Bar material testing requires ultra-high acquisition rates 100K - 5M fps. In this example, a bullet impacts glass, showing strain concentration during the crack propagations (recorded at 1Mfps).



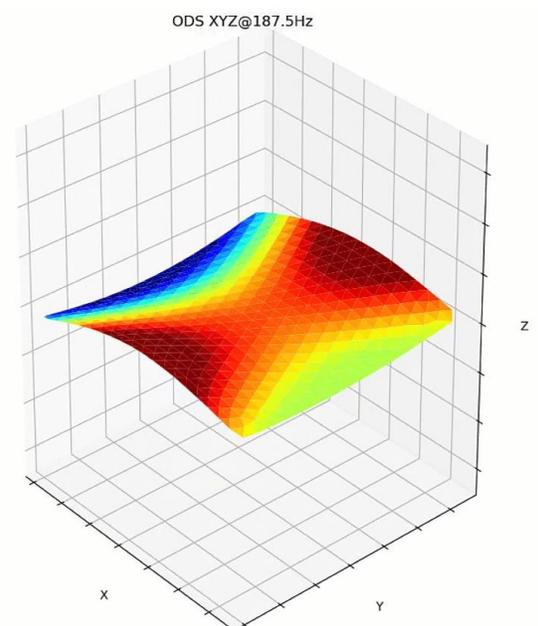
Vibration

Vibration Analysis of structures with ARAMIS provides non-contact, massless acceleration and vibration data with minimal set-up time, providing precision FFT and vibration waveforms at any point on complex structures. Typical examples include, ARAMIS matched 50 accelerometers, taking two weeks to setup and calibrate, with one ARAMIS system ready to go in 2 hours. ARAMIS High-Speed, originally developed for the NASA Space Shuttle Return-to-Flight ballistic impacts, has become the mainstay of the Industry 4.0 vibration industry.



Modal Analysis with ARAMIS High-Speed captures the dynamic 3D shape of the component. The ARAMIS FAST frequency analysis module displays FFT and the operational deflection and mode shapes at each frequency. Since all points are captured synchronously, the full phase relationship on the modal response is highly accurate, unlike single point measurement systems like laser vibrometers.

Ground Vibration Testing (GVT) for the entire vehicle shows the power of our full-field methods, providing the global 3D displacements, local buckling and modal response, across the entire vehicle. TRITOP automatically aligns every ARAMIS result into CAD coordinates providing seamless full-vehicle measurements.



Aerospace Toolbox

<p>ARAMIS Optical Strain</p>		<p>ARAMIS Optical Strain is a full-field, non-contact measuring system based on 3D digital image correlation photogrammetry.</p>
<p>ARAMIS High-Speed</p>		<p>ARAMIS High-Speed is the ideal 3D optical sensor for a wide range of high-speed measurements, for 3D shock vibration and dynamic testing, and analysis.</p>
<p>TRITOP Photogrammetry</p>		<p>TRITOP system portably measures 3D coordinates of complex objects precisely and provides large area automatic stitching for ARAMIS.</p>
<p>ARGUS Forming Analysis</p>		<p>ARGUS Forming Analysis supports the optimization of the sheet metal forming process and optimization of tools. ARGUS Laser Etcher provides perfect etching.</p>
<p>RVAT Digital Assembly</p>		<p>Digital Manufacturing with RVAT (Real-time Virtual Assembly Tooling) provides precision assembly guidance and complete data for the Aerospace Digital-Twin.</p>
<p>GOM CT</p>		<p>GOM (CT 3D-X-ray) is a state-of-the-art metrology CT scanner capable of the highest accuracy and resolution in the industry, for internal dimensioning, SPC, AM QA, etc.</p>
<p>GOM ScanBox</p>		<p>ScanBox brings full robotic automation to test measurements, for repeatable precision measurements every time.</p>

Benefits and ROI

ARAMIS 3D Optical Strain is transformational imaging technology power to test engineers, allowing them to meet the testing requirements of the advanced CAE computer modeling. Testing with single mechanical point sensors no longer provides the quality of data necessary for precise model validation. Composites and Additive Manufacturing particularly have pushed components and assemblies to the design limits, so all points of the structure need to be verified.

Engineering Design looks to have their models validated accurately, as well as quickly and efficiently. This is more and more critical every year, especially with increasing competition. ARAMIS optical strain is 10X cheaper than traditional gages, 50X less labor, and 100X more data for better model validation {Boeing}. Companies need their ever more complex models to be precisely validated, so that they can rely on them. Testing with ARAMIS optical strain will be needed to do this critical work.

Lightweighting Designs and assemblies are super-critical in their design and function. ARAMIS optical strain provides full-field and integrated measurement of all components working together. Complex materials, component assemblies and complete systems are difficult to model; ARAMIS sees precisely how they work together, from fit (3D Shape) to 3D displacements, to interface strains to vibrational responses, making ARAMIS a critical tool for the industrial testing.

Stage 25

TRACT Post Test Preliminary Analysis 9-3-2013



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Trilion Quality Systems

trilion.com

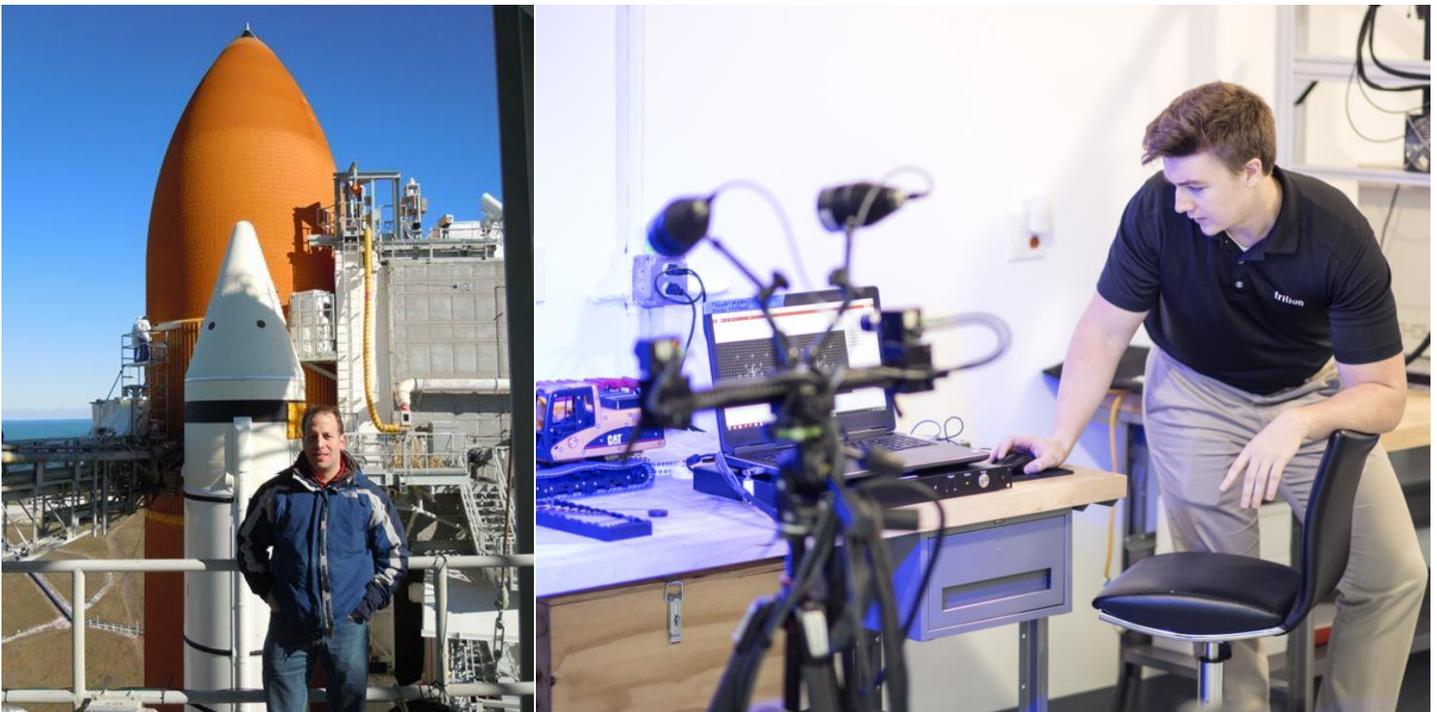
Trilion Engineering Services

Trilion Engineering Services are the perfect solution for solving complicated applications or developing measurement methods for a critical measurements. We provide experienced engineers, with industry specific experience from material characterization, to advanced testing, in aerospace and many other industries including automotive, microelectronics, civil structures, power generation and consumer products.

Some examples of our engineering Services include:

- Full field 3D displacement map during component testing
- Optical strain field for FEA validation
- High-speed measurements and vibration analysis
- Large scale structural testing

We look forward to supporting our customers and applying our technologies to solve problems. We get professional results every time.



All-in-One Solution

Trilion Quality Systems has been an industry leader in Optical Metrology Systems for over 20 years, developing and supporting unique applications throughout North America. Optical metrology brings long-awaited advanced Factory 4.0 capabilities to the manufacturing industry.

Trilion Engineering Services is the perfect solution for companies who have a complicated application need measurement method development, or professional measurements. Our experienced level 3 engineers and precision system to get professional results every time.

A manufacturing revolution, reducing costs and improving quality!

ARAMIS Optical Strain is the tool of choice for industry leaders!

Trilion customers are industry leaders, and their operations are the best proof of the importance of this optical metrology in manufacturing.





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