



Digital Material Testing Guide

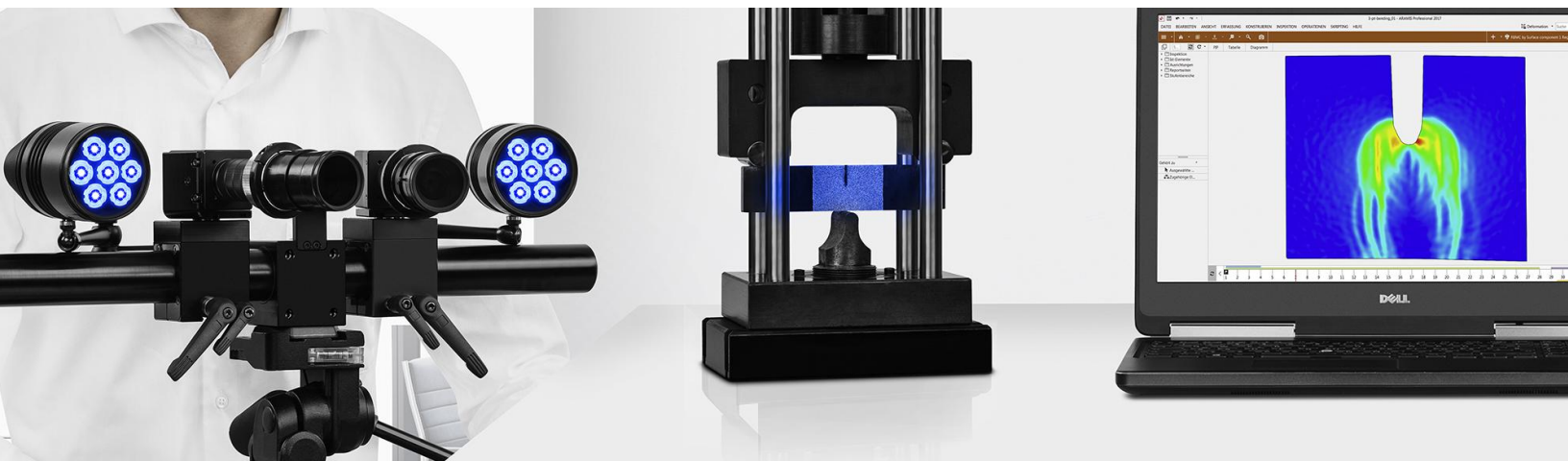
Optical Material Testing

**Full-Field Testing
Automated Workflow
Certified Measurements**

trillion

Save Labor, Costs, and Schedule.
A Complete, Certified, Digital Testing Ecosystem

Optical Material Testing



A Complete, Certified, Digital Testing Ecosystem

Modern material testing requires more than single-point sensors. Engineers need real-time control, full-field insight, certified results, and automated workflows to accurately characterize material behavior.

Traditional approaches—based on strain gauges and clip extensometers—provide limited spatial data and often require extensive sample testing to achieve consistent material properties. Digital Material Testing transforms this process.

By combining real-time 3D extensometry, full-field optical measurement, certification, and automation, Trilion Quality Systems delivers a complete, scalable ecosystem that streamlines testing from specimen preparation through certified reporting.

The Shift: From Single-Point to Full-Field Measurement

Traditional Testing	Digital Optical Testing
Single-point measurement (strain gauges, clip gauges)	Full-field 3D measurement (thousands of data points)
High sample counts required for statistical consistency	Reduced sample requirements
Limited visibility into localized behavior	Complete strain and deformation insight
Manual setup and operator variability	Real-time feedback and automation

Full-field measurement enables a deeper understanding of material behavior—capturing what single-point sensors cannot.

Digital Material Testing Ecosystem

ARAMIS Optical Strain: Full-Field Material Insight

A full-field 3D Digital Image Correlation (3D-DIC) system that delivers accurate material behavior for simulation validation and material characterization.

- Full-field 3D displacement, strain, and deformation measurement
- ASTM E83.25–certified, NIST-traceable accuracy
- Reduces sample counts with complete insight

Result: Comprehensive understanding of material properties.

XiGage – Real-Time 3D Extensometry

A non-contact 3D video extensometer for real-time machine control.

- Ultra-low latency for closed-loop testing
- ASTM E83.25–certifiable measurements
- Replaces clip gauges and 2D extensometers

Result: Real-time, plug'n'play, certified contactless measurements.



t.Cert – Measurement Certification

Enables ASTM-compliant validation of optical measurements.



- NIST-traceable verification
- Automated accuracy validation
- Certification embedded in reports

Result: Enables ASTM-compliant validation of optical measurements.

t.Cut – Automated Sample Cutting

Fast, repeatable sample preparation

Result: Simplified, consistent cutting.

t.Etch – Automated Sample Preparation

Optimized DIC patterning for consistent results.

- Repeatable precision patterns
- Reduced setup variability
- Batch Processing

Result: Better accuracy and repeatability.

t.Suite – Automation Platform

Unified workflow automation for digital testing.

- Guided workflows and batch processing
- Automated calibration and reporting
- Digital-twin Integration

Result: Repeatable, scalable, and efficient testing operations.

ARAMIS Optical Strain

Full-Field 3D Material & Structural Insight

Using advanced 3D Digital Image Correlation (3D-DIC), ARAMIS Optical Strain captures full-field displacement, strain, and deformation across the entire specimen, revealing true material behavior in real time.

ARAMIS Optical Strain is the industry standard for digital material testing. "GM colleagues have sensor envy."

ARAMIS 3D sensor is designed for ease of use and long-term stability.



Certified Performance. Automated Power.

t.Cert measurement certification to ASTM E83, opens the doors for certified optical measurements.

ARAMIS Templates provide automated testing and reporting for regular testing.

t.Suite (Trilion Automation Suite) customizes your control and results for fully tailored digital material properties and testing.



ARAMIS 1

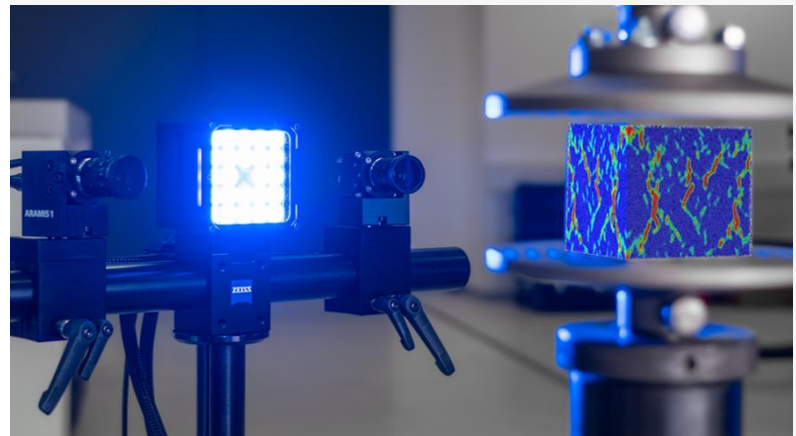
Your Entry Point into 3D Optical Testing

ARAMIS 1 makes professional 3D optical strain measurement more accessible than ever.

Designed as a streamlined, easy-to-use system, ARAMIS 1 delivers:

- Powerful optical measurement capabilities
- Entry-level pricing without compromising accuracy
- A clear upgrade path to advanced ARAMIS systems

It is the ideal starting point for labs transitioning from clip gauges and strain gauges into full-field 3D measurement.



**Measure Everything.
Validate Reality.**

ARAMIS Optical Strain transforms material testing from single-point assumptions to a complete 3D understanding.

t.Cert – Measurement Certification

Certified Accuracy Starts with Repeatable Preparation

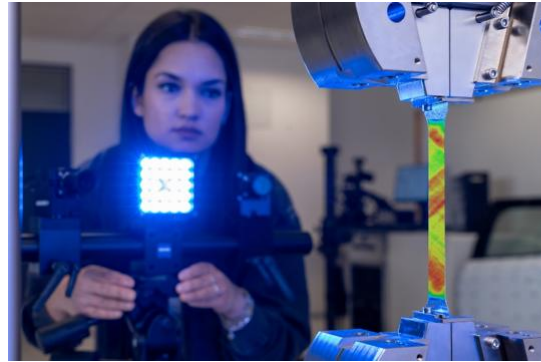
Reliable Digital Image Correlation starts before the test begins. t.Cert and t.Etch help labs reduce variability, improve repeatability, and create a more traceable workflow from specimen preparation through final reporting.

t.Cert: Certified Optical Strain Measurement

t.Cert enables ASTM E83.25-aligned certification of optical measurement systems using NIST-traceable verification. Certification status can be embedded directly into reports, helping labs document accuracy and support regulated testing requirements.

Key Benefits:

- Verifies system calibration status
- Confirms measurement accuracy
- Validates 3D-DIC performance
- Supports traceable reporting



t.Etch – Automated Patterning

t.Etch: Automated Patterning for DIC Testing

t.Etch replaces manual spray patterns with controlled, repeatable laser-etched patterns.

Key Benefits:

- Creates consistent speckle patterns
- Improves signal quality and repeatability
- Supports batch processing and specimen traceability



Together, t.Cert and t.Etch helps labs improve confidence in every test by reducing preparation and setup variability, standardizing workflows across operators, and strengthening the path to certified digital material testing. From specimen preparation to final reporting, they create a more repeatable, traceable, and defensible testing process.

Trilion XiGage

Real-Time 3D Digital Extensometry

Traditional extensometers limit testing speed, flexibility, capability and durability. Unlike single-camera systems that assume flat, perfectly aligned motion, XiGage is a stereo camera system that measures in true 3D space and certifiable. This improves accuracy and reliability during bending, twisting, or out-of-plane motion, delivering more accurate materials properties measurements.

Designed for real-time machine control, XiGage delivers ultra-low latency displacement and strain feedback, enabling closed-loop control while maintaining ASTM-certifiable accuracy.

Measuring full-field, displacement, strain, transverse strain, Poisson's ratio all simultaneously.

Seamless Integration with ARAMIS

XiGage serves as the ideal entry point into full-field optical measurement.

When deeper material behavior analysis is required, XiGage can save images for complex ARAMIS postprocessing for complete 3D full-field data analysis.



Certified. Non-Contact. Reliable.

Unlike mechanical gauges, XiGage:

- Requires no contact with the specimen
- Live view monitoring
- Removes mass loading effects
- Reduces setup time and recalibration downtime

Built for Machine Control

XiGage provides:

- Ultra-low latency feedback for closed-loop testing
- High-resolution 3D strain and displacement measurement
- Complex measurements can be configured.
- Seamless integration with load frames and controllers
- Reliable performance through large deformation and failure

**Real-Time.
Certified. 3D.**

XiGage modernizes extensometry, combining certification-grade accuracy with the speed and flexibility of optical measurement.

t.Suite

Measurement Automation for Optical Testing

Modern testing labs demand more than accurate measurements; they require repeatability, efficiency, and scalable workflows and digital-twin analysis to precision material cards.

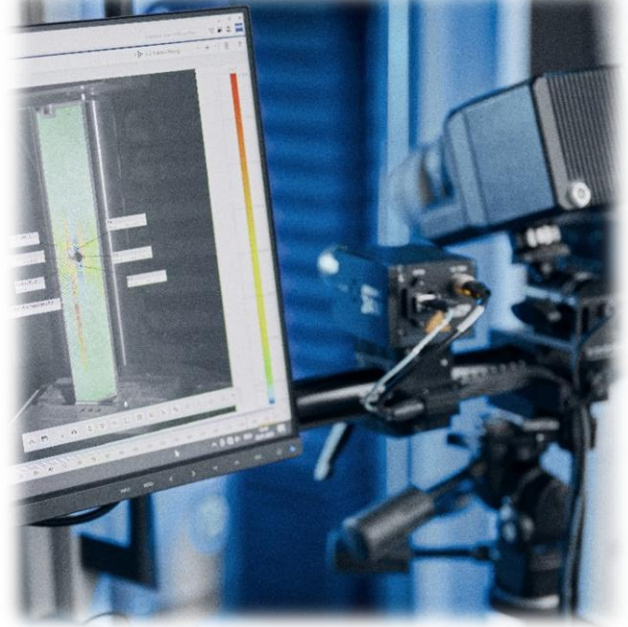
t.Suite (Trillion Automation Suite) connects hardware, software, and data into a unified digital testing ecosystem, transforming optical material testing into a streamlined, Industry 4.0 process, gathering more data from every test, and reducing the testing effort.

Simplify. Standardize. Scale.

t.Suite reduces operator variability and testing complexity by delivering:

- Guided, task-specific user interfaces
- Automated calibration management
- Batch processing for large test series and campaigns
- Advanced data analysis, using full-field data
- Direct database integration and reporting

By focusing on only the functions required for each workflow, t.Suite improves material property accuracy and consistency while reducing training and operational time.

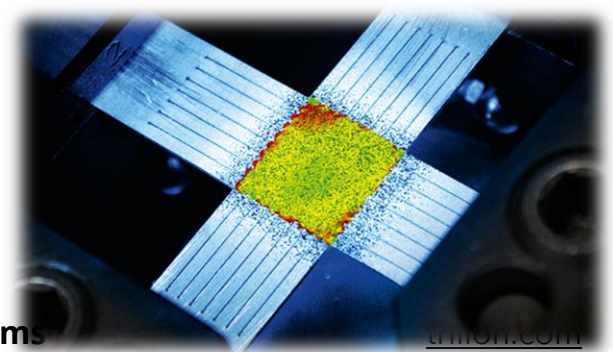


Built for High-Throughput Labs

From material testing campaigns to dynamic and thermal testing programs, t.Suite enables:

- Automated material property calculations
- Template-driven measurement setup
- Full-field data analysis to fully understand each sample beyond a single gauge
- Digital report generation
- Seamless integration with ARAMIS, XiGage, and external sensors

Large datasets are processed efficiently while maintaining precision and documentation integrity.

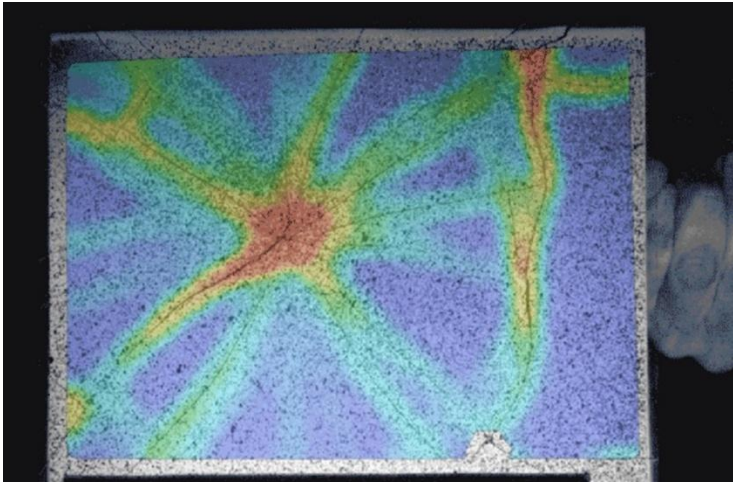


ARAMIS High-Speed

Full-Field 3D Measurement for Dynamic Testing

When material behavior happens too fast to see, ARAMIS High-Speed makes it measurable. By combining high-speed cameras with ARAMIS Optical Strain software, engineers can capture full-field 3D deformation, displacement, strain, and acceleration during fast, complex events or vibrational studies.

ARAMIS High-Speed supports testing from thousands to millions of frames per second, making it ideal for high-strain-rate material testing, vibration analysis, impact, crash, ballistic, blast, and Split Hopkinson Bar applications.



Capture what Contact Sensors Miss

Traditional sensors only measure isolated points. Full-field data and the actual image data tell a much deeper story. Described as the FEA of Testing, ARAMIS Optical Strain with integrated high-speed cameras tells a more complete story.



Capture what Contact Sensors Miss

Traditional sensors only measure isolated points and can be difficult to use during rapid or destructive tests. ARAMIS High-Speed turns high-speed camera images into full-field 3D measurements, capturing thousands of data points without contacting the specimen.

Key capabilities include:

- Full-field 3D deformation and strain measurement
- High-strain-rate material characterization
- Impact, crash, drop, ballistic, and blast analysis
- Split Hopkinson Bar and brittle fracture testing
- Full-field vibration and Operational Deflection Shape analysis
- Data for simulation validation and material model improvement

ARAMIS High-Speed

When it's too fast to see, we can still measure it!

ARAMIS Thermography: Thermal Expansion

ARAMIS Thermography combines full-field 3D strain measurement with thermal imaging to separate thermal and mechanical effects for accurate material and structural characterization. Thermal data is mapped into 3D space, enabling synchronized analysis across entire specimens or systems, and providing reality to computer models. The FEA of Testing, as described by NIAR

Key Capabilities:

- Temperature in 3D coordinates mappable to FEA
- Full sample thermal expansion measurement
- In the Thermal Chamber or in reality
- Synchronized high-speed ARAMIS thermography
- Full-field strain temperature correction
- Thermo-mechanical analysis from samples to full systems

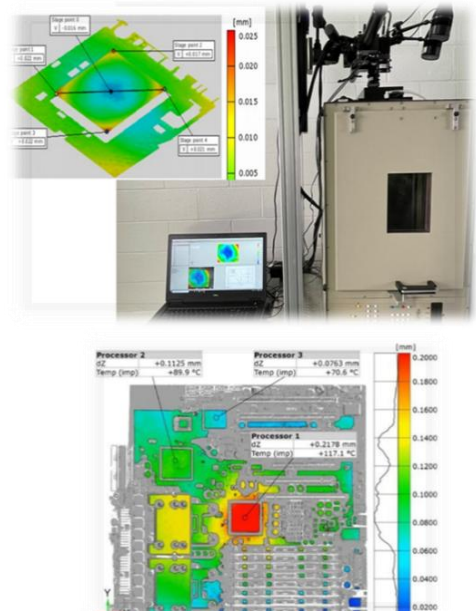
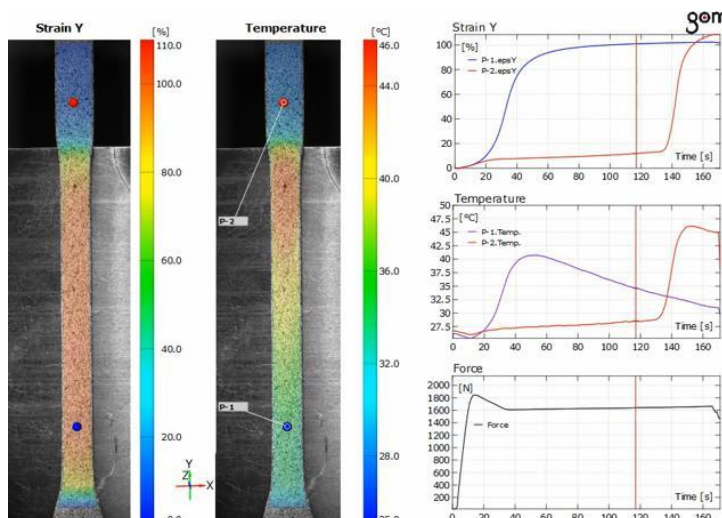


ARAMIS Gleeble (>2000°C)

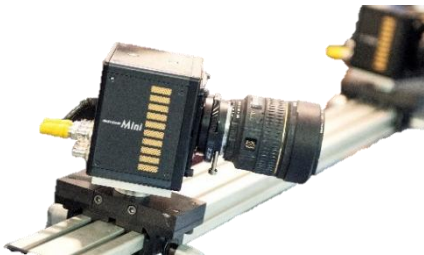
Enables full-field, non-contact strain measurement at ultrahigh temperatures. Integrated with Gleeble systems for realistic thermo-mechanical testing and accurate material evaluation.

Key Capabilities:

- Full-field 3D strain measurement at extreme temperatures
- Synchronized thermo-mechanical data
- Accurate material property generation



3D Metrology Toolbox

ARAMIS Optical Strain		ARAMIS Optical Strain is a certified, full-field, non-contact measuring system based on 3D digital image correlation & dynamic photogrammetry.
XiGage Real-time Gage		XiGage - 3D video extensometer, real-time plug'n'play sensor, easier than a clip gauge, 1000x better, meets ASTM E83 measurement certification.
ARAMIS High-Speed		ARAMIS High-Speed is the ideal 3D tool for precision high-speed measurements, vibration, dynamic testing & analysis, SHB to 5M fps, impact, ballistic & blast.
ARAMIS Thermography		Thermography uniquely reads full-field temperatures in 3D coordinates. This cutting-edge data provides a broad understanding of materials, structures, and processes on material properties
T-SCAN hawk 2 Laser Scanner		The T-SCAN hawk 2 is a next-generation, handheld 3D laser scanner that delivers exceptional accuracy in a lightweight, portable design.
ATOS 3D Scanners		ATOS non-contact structured- light 3D scanner designed for repeatable, precise measurements of 3D shape and integrated with ARAMIS & TRITOP.

Return on Investment (ROI)

Digital Material Testing transforms testing from a labor-intensive, sample-heavy process into a fast, data-rich, and scalable digital workflow, delivering faster decisions, lower costs, and higher confidence in material performance.

Faster Testing. Fewer Samples. Better Data.

Digital Material Testing delivers measurable improvements across cost, speed, and data quality by replacing single-point measurement with full-field optical insight.

Reduce Test Costs

- Eliminate consumables (strain gauges, adhesives, wiring, clip gauge failure)
- Equivalent to an advanced set of all gauges
- Reduce fixture complexity and setup time
- Minimize recalibration and replacement costs

Impact: Lower cost per test and reduced overhead

Reduce Sample Count

- Capture thousands of data points in a single test
- Use virtual extensometers and full-field integration
- Eliminate invalid tests due to sensor placement

Impact: Less material waste and fewer retests

Accelerate Testing Programs

- Rapid setup with non-contact measurement
- No sensor installation or removal
- Automated workflows and reporting (t.Suite)

Impact: 10 × faster testing and shorter development

Improve Data Quality

Full-field measurement with certified, traceable accuracy.

Impact: More reliable results and precision FEA input data

More Insight

Capture real-world behavior, including failure and localized effects.

Impact: Improved designs and reduced overdesign



Typical Performance Gains

10x lower measurement cost
(vs. traditional gage-based methods)

50x reduction in labor effort

100x more data per test

(Findings from Boeing)



For more information, visit:
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