Zwick / Roell

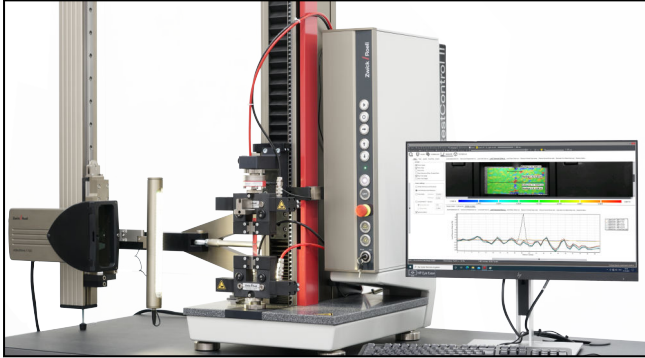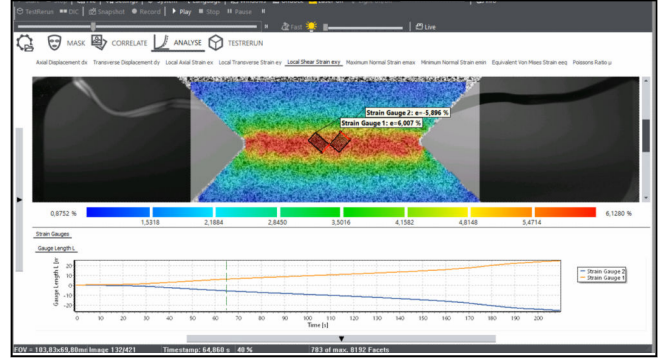# Product Information
2D Digital Image Correlation: Simply See More

2D digital image correlation with videoXtens and testXpert III

Composite v-notched rail shear test to ASTM D7078

What is 2D digital image correlation?

2D digital image correlation visualizes deformations and strain over the entire visible specimen surface. The non-contact videoXtens extensometer records image series during the test, compares image by image, and calculates the displacement in a pre-defined facet field, where each facet includes a specified number of camera pixels. This data is used to create two-dimensional color strain maps, which allow you to analyze the specimen behavior at a glance.

Why 2D digital image correlation (DIC)?

Through 2D DIC, in combination with standard strain measurement, you gain valuable additional information on specimen behavior for specimens that maintain a plane surface throughout the test.

The ZwickRoell 2D DIC option makes local strains visible in 2D over the entire specimen surface:

- Color displays of specimen behavior provide indications of inhomogeneous local strain and other special features.
- You can also analyze complex specimens with notches or non-homogeneous materials.
- Errors in the test arrangement, such as inaccurate specimen alignment quickly become visible.

Simply see more: the 2D DIC software option for ZwickRoell videoXtens systems

The 2D DIC option does not require additional hardware. The software option is simply combined with the videoXtens and expands the already installed strain measurement system with an additional functionality.

This allows for live strain measurement with a single extensometer, after which the 2D DIC analysis can be carried out.

ZwickRoell array systems offer you high resolution combined with a large field of view. They include several cameras, such as the videoXtens 2-120 HP. This simply allows you to see more in 2D DIC mode.

Convenient evaluation with testXpert III: a single software system for live strain measurement and 2D DIC-analysis

The 2D DIC option was developed in-house at ZwickRoell and is fully integrated in testXpert III. With just one software system, live measurement and 2D DIC-analysis are performed and all measured values are managed.

- Measured values, test results and images are stored, managed and evaluated together. You can easily and extensively analyze all measured values with each other. Strain values of a gauge length defined in the 2D DIC can be displayed and evaluated in a stress-strain curve.
- You will reach your goal quickly and with just a few clicks: by specifying a workflow, you are guided step by step from setup to analysis and display of the measured values.
- Prepare analysis parameters once, then save them in testXpert and use them over and over.
- Reliable results: the 2D DIC-measured values are synchronized with the measured values of the testing machine.
- Through the test re-run option for each evaluation a new specimen is added whenever you choose. This makes evaluation retrievable.

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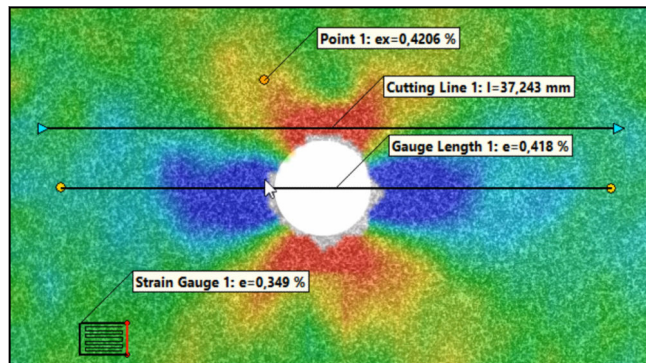
Simple specimen preparation

A high-contrast pattern can simply and quickly be sprayed onto the specimen.

Additional markings are not necessary for the live strain measurement. Virtual gauge marks are placed on the existing pattern through the software.

DIC setup: go with the (work) flow

Operating the 2D DIC is simple and intuitive. By specifying a workflow, you are guided step by step from setup to analysis and display of the measured values.
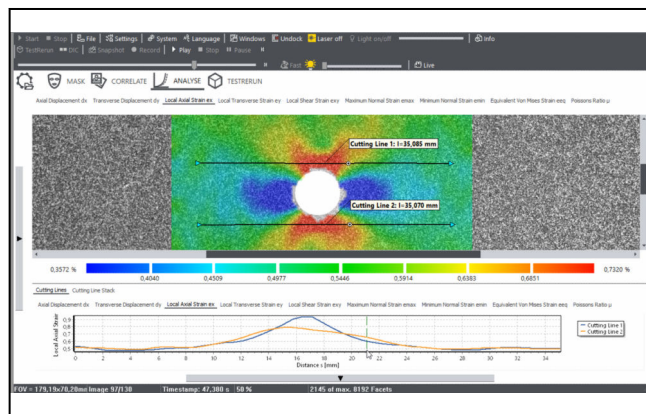

CTA: 252297

A mask defines the image region to be analyzed.

1. Defining masks and grids

Easily define the image region to be analyzed by means of a mask. Using a toolbox of mask geometries such as circles or polygons, you can also create irregular masks or define recesses. You also have the option of using multiple masks for which different resolutions can be specified.

Three very helpful default settings are available to define the facets and resolution. Settings can also be individually selected or adjusted.

In addition, measurements can be carried out on different planes that have varying distances to the test axis, which is the case with offset specimens for example. Here, the distance from the specimen plane to the test axis can be individually adjusted.

2. Starting the correlation

The correlation is used to calculate the displacements and strains between facets using the parameters defined in the mask.

Images such as those recorded after specimen fracture can be selectively deselected for the correlation.

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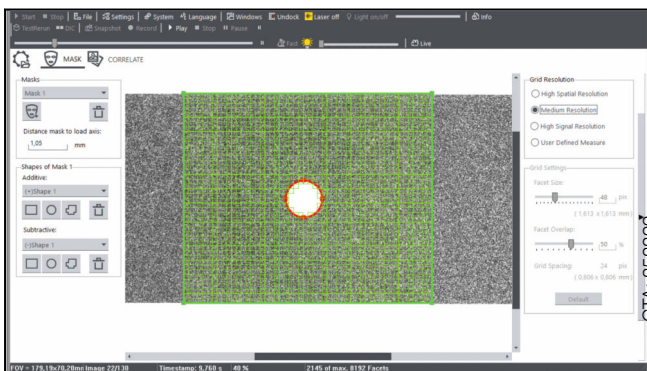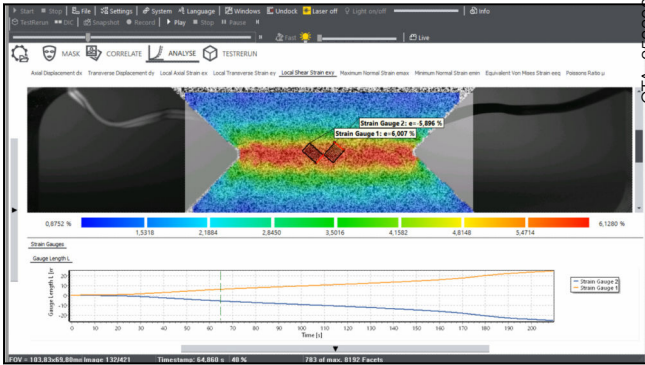Different analysis tools of the 2D DIC

3. Analysis

You have a wide selection of analytical tools and displays at your disposal for the analysis process. The color map and diagram are clearly displayed in a common analysis layout.

CTA: 252299

Various graphical evaluations are available for each analysis tool. Here you can see the course of axial strain along two intersecting lines to the left and right of the hole of an open-hole tension specimen.

Analytical tools, such as gauge lengths, can be moved on the color map using the mouse, while simultaneously displaying the current values in the diagram – without time delay! You can use the timeline to access any point in time within the test.

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Analysis tools can be moved using the mouse, which simultaneously changes the graphical evaluation.

Analysis tools in 2D DIC

- Measuring points: these can be placed in any desired locations within a strain map.
- Gauge lengths or virtual extensometers: establish two points on the strain map, between which the change in distance is to be determined.
- Intersections: the strain progression is visualized along the lines. The intersection deforms with the specimen. In addition, there is an intersection stack through which selected time steps are displayed in a diagram, making the time-based development of the intersection visible.
- Virtual strain gauges: for the virtual strain gauges, you can individually define the position, size and angle. In addition, multiple virtual strain gauges can be placed on top of each other at different angles. For example, two virtual strain gauges can be combined to form a biaxial strain gauge with measuring grids oriented at 90° to each other. The virtual strain gauges can save you a lot of time and cost.

Intersection stack: Selected time steps are displayed in a diagram, making the time-based progression of the intersection visible.
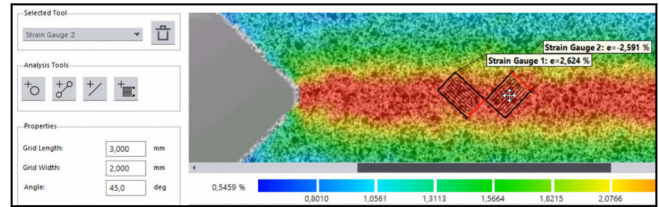
The virtual strain gauges can also be placed on top of each other at different angles.

Graphical display / diagram
The following measured values can be displayed as strain maps and in diagrams:
- Displacements in X direction
- Displacements in Y direction
- Local longitudinal strains ε_x
- Local transverse strains ε_y
- Local shear strains ε_{xy}
- Maximum normal strains
- Minimum normal strains
- Poisson's ratio
- Equivalent Von Mises strains
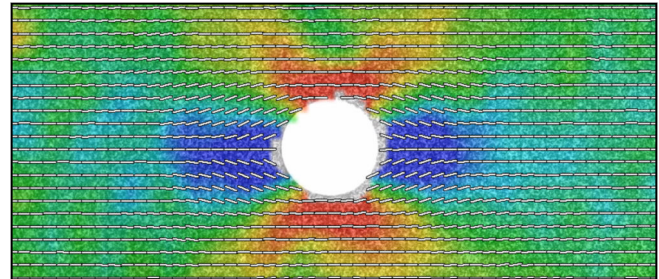
Vector maps visualize the main strain directions.

Vector maps can be displayed in all strain maps, showing the main strain directions.

Export options:
- Export of individual data in .csv
- Export of the video in .avi
- Export color map / diagram in .bmp
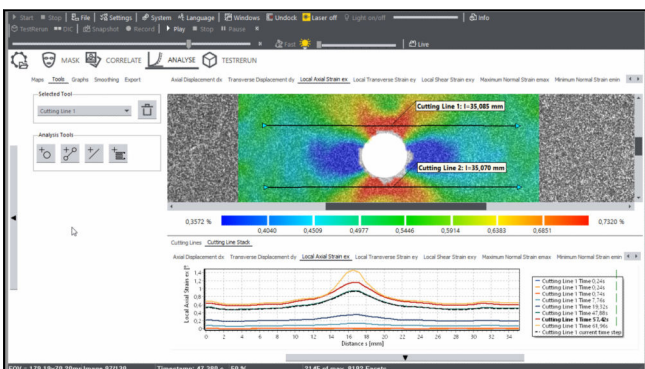
4. Test re-run
Results of the individual 2D DIC analysis tools are combined with the measured values of the live test via the test re-run option in testXpert.

The results of the 2D DIC analysis tools are synchronized with the force signal from the testing machine, so that a stress-strain curve can be easily generated, which can then be evaluated in testXpert III as usual.

The test re-run function can be executed multiple times. A new specimen is added each time, which allows the

All data at ambient temperature.

Subject to change in the course of further development.

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evaluation to be retrieved whenever you choose, and previous evaluations with other analysis tool settings are retained.

Technical data

Description	Value	
Type	2D Digital Image Correlation	
Item No.	1018509	
Frame frequency	Up to 50	Hz
Resolution specifications for virtual strain gauges with an edge length of 5x5 mm are dependent on the videoXtens system version:		
videoXtens 1-120	90	µStrain[1]
videoXtens 1-270	150	µStrain
videoXtens 3-300	90	µStrain
videoXtens 2-120 HP	25	µStrain
videoXtens biax 2-150 HP	20	µStrain
Minimum version	testXpert III V1.61	

[1] Explanation of the resolution specification: 100 µStrain correspond to 0.01% extension. Based on a gauge length of 5 mm, 100 µStrain correspond to a resolution of 0.5 µm.

The accuracy and resolution of the virtual gauge length corresponds with the videoXtens system used, i.e. videoXtens biax 2-150 HP: 0.15 µm and accuracy class 0.5 (ISO 9513)