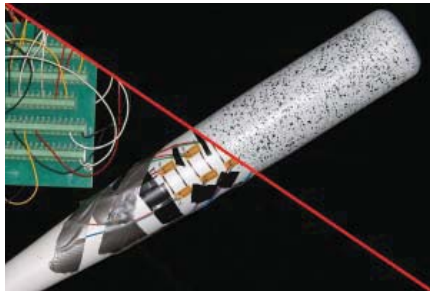


# Dynamic Deformation Measurement

## SOLUTIONS

### High-Speed Capabilities

- Various camera models available offering a wide range of speeds and resolutions
- Extremely light-sensitive image sensors for easy illumination
- Up to 10,000,000 fps now available
- Completely integrated and customized turn-key systems with training
- High-powered cool LED lighting systems available

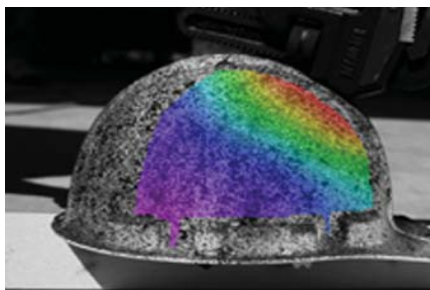
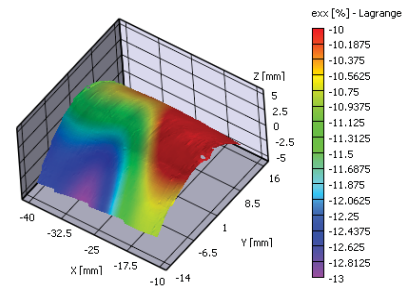


### Non-Contact

- No mechanical interaction with your sample
- Eliminates the need for strain gauges, LVDTs, extensometers, etc.
- Fast and easy sample preparation
- Rigid body motion can be easily removed
- Measure dynamic mechanical properties AND vibration at the same time

### User-Friendly

- No optical isolation table needed
- Safe, simple and intuitive system
- Robust system calibration with automatic target spacing detection
- Remotely control cameras with an iOS or Android device
- Cut & paste graphs and plots into any MS Windows application
- Fast data processing with intuitive inspection and extraction tools



### Full-Field Measurements

- Eliminates the need for precise strain gauge placement
- Up to 4,000,000 data points possible
- Automatically identify strain concentration locations, even in complex structures under complex loading conditions
- Fast data processing: up to 55,000 data points/second
- Data can be exported for easy FEA comparison/validation

The Correlated Solutions VIC-3D measurement system can save you valuable time while improving the quality of your deformation or strain measurements. Specimen preparation is simple and quick, and your test specimen is not affected by the measurement process. It might sound too good to be true, but it has been field-proven by professionals like you. Give us a call to find out how you can increase lab throughput, while increasing data quality.

[www.correlatedsolutions.com](http://www.correlatedsolutions.com)

Correlated Solutions, Inc.  
121 Dutchman Boulevard, Irmo SC 29063  
T: 803-926-7272 F: 803-749-7569

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# Application Example

## High-Speed Compression Test

Studying the behavior of metals during a high-speed dynamic compression event has always been challenging due to the complex test set up and fast data capture rates required. Currently, very little literature is available regarding deformation behavior at strain rates of 10 to 500s<sup>-1</sup>. Utilizing high-speed cameras, the VIC-3D HS system can be used to quantify the surface displacements and strains in three dimensions over the entire field with great precision. Digital Image Correlation (DIC) has gained widespread popularity over recent years in such high-speed applications due to its high accuracy, flexibility and ease of use.

In this example, a 6mm diameter cylindrical specimen is compressed at a strain rate of 50s<sup>-1</sup>. The VIC-3D HS system was used to capture the surface displacements and strains on the specimen during the event. Figure 1 shows the test setup with the high-speed cameras focused on the specimen. A random speckle pattern is applied to the specimen that allows the analysis software to easily track the deformation to sub-pixel accuracy. Although the high-speed cameras are capable of much higher capture rates, for this test they were set to an appropriate frame rate of 14,400fps to maximize spatial resolution while acquiring an adequate number of images during the event. The cameras were post-triggered at a resolution of 1024 x 400 pixels. After the event, the images are transferred to the computer's hard drive, and then post-processed using VIC-3D analysis software. Figure 2 shows a full-field contour plot of the transversal strain (Exx) overlaying the raw image at t = 4.4ms. The compressive strain observed was found to be non-uniform.

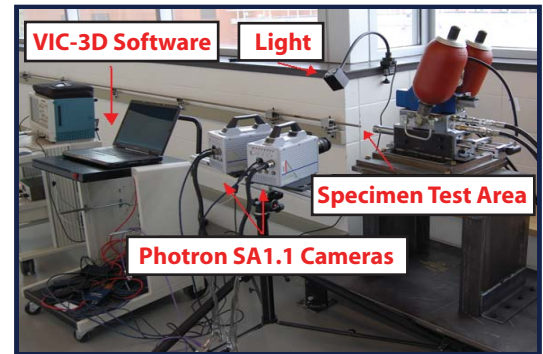


Figure 1. VIC-3D HS Test Setup

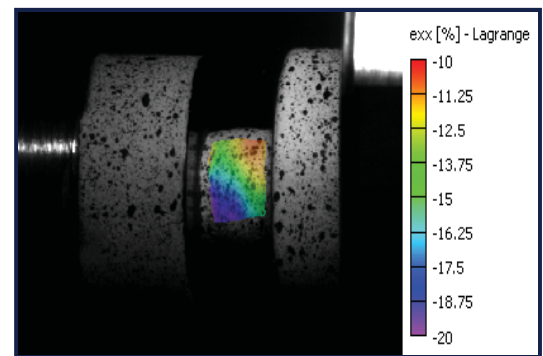


Figure 2. Contour image overlay of transverse strain at t = 4.4 ms

## Specifications

The content from Ohio State University is greatly acknowledged

|  | VIC-3D SR/HR/XR   | VIC-3D CL  | VIC-3D HS                         | VIC-3D U-HS          |
|--|---|--|-----------------------------------|----------------------|
| <b>Camera Resolution</b>   | Up to 29 Megapixels   | Up to 4 Megapixels                                   | Up to 4 Megapixels                | 400 x 250 pixels     |
| <b>Frame Rate</b>  | Up to 110 fps   | Up to 500 fps  | Up to 300,000 fps                 | Up to 10,000,000 fps |
| <b>Exposure Time</b>   | 20µs – 10s  | Down to 20 µs  | Down to 368 ns                    | Down to 50 ns        |
| <b>VIC-3D Data Variables</b>   | 3D displacements, strains tensors, strain rates, velocities, accelerations, and much more |  |                                   |                      |
| <b>Analog Data Recording (inputs)</b>  | Up to 32 inputs   | Up to 16 inputs                                      | Up to 8 inputs                    | Up to 2 inputs       |
| <b>VIC-3D Full-Field Real-Time Analysis</b>  | Yes, up to 10Hz   | Yes, up to 10Hz                                      | n/a                               | n/a                  |
| <b>VIC-Gauge 3D Real-Time Analysis (output of points, gauges, extensometers, etc.)</b> | Yes, up to 100 Hz<br>Up to 4 real-time analog outputs                                     | Yes, up to 100Hz<br>Up to 4 real-time analog outputs | n/a                               | n/a                  |
| <b>Camera Disturbance Correction</b>   |   |  | Included                          |                      |
| <b>Multi-System Stitching (requires multiple camera systems)</b>                       |   |  | Included                          |                      |
| <b>Marker Tracking</b>   |   |  | Included                          |                      |
| <b>Measurement Area</b>  |   |  | mm <sup>2</sup> to m <sup>2</sup> |                      |
| <b>Strain Measurement Resolution</b>   |   |  | 50µε                              |                      |
| <b>Strain Measurement Range</b>  |   |  | 0.005% to >2000%                  |                      |
| <b>VIC-3D HS Vibration Analysis Module</b>   | Available with VIC-3D Fulcrum   | Available  | Available                         | n/a                  |



Edificio Antalia  
Albasanz, 16  
28037 MADRID  
Tel.91 567 97 00  
Fax:91 570 26 61

[www.alavaingenieros.com](http://www.alavaingenieros.com)

Torre Mapfre-Vila Olímpica  
Marina, 16 - Planta 11-C2  
08005 BARCELONA  
Tel.93 459 42 50  
Fax:93 459 42 62

[alava@alava-ing.es](mailto:alava@alava-ing.es)

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