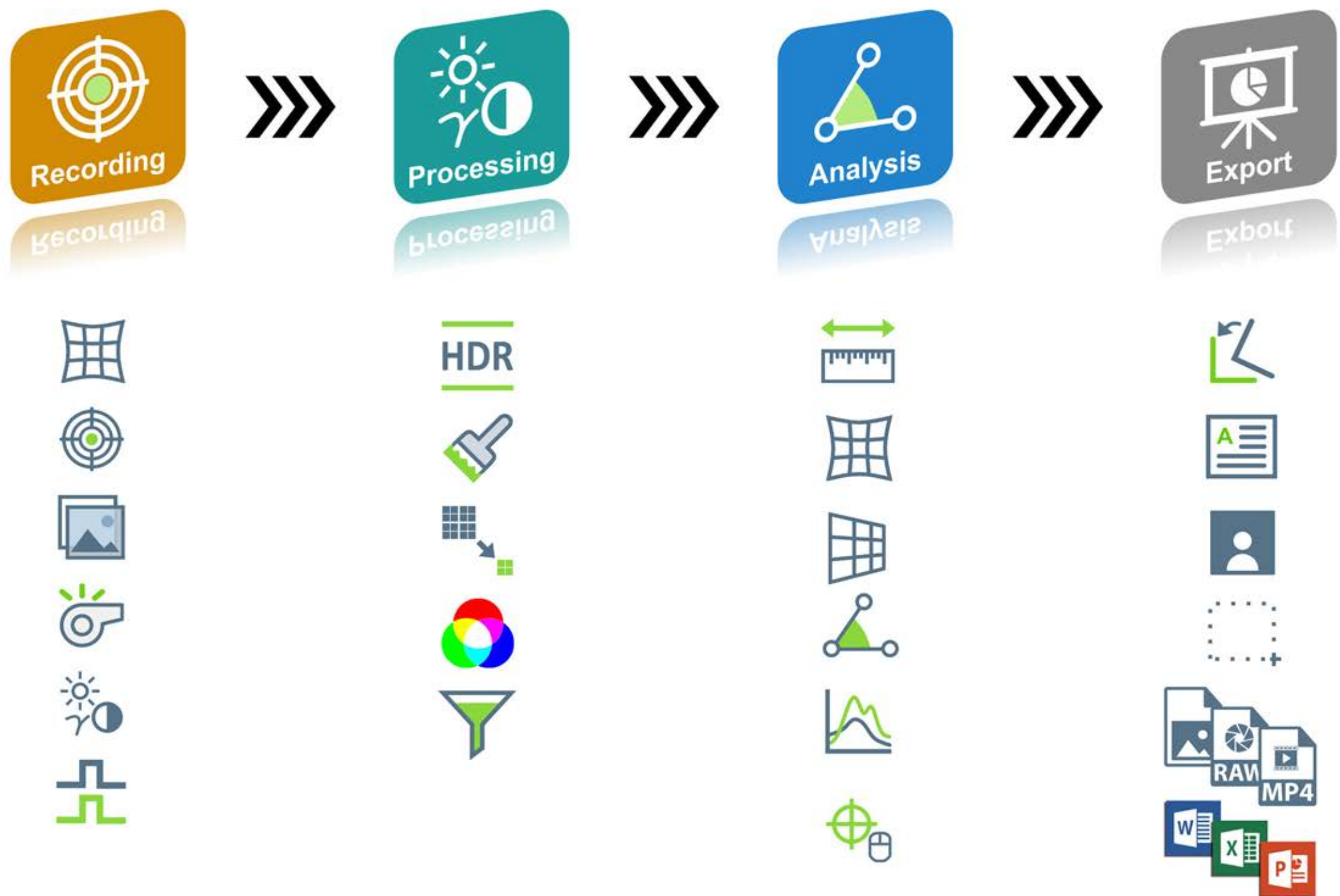


Photron



Photron *FASTCAM Viewer* 4 for High Speed Digital Imaging

For 20 years, users have praised the intuitive nature of the Photron FASTCAM Viewer.

This next generation of PFV maintains the usability of previous versions by delivering not only the expected functionality required for camera configuration and image capture, but also powerful time-saving tools for post processing, image analysis, data acquisition and PFV Mobile for Microsoft® Windows, Android and iOS tablet devices. PFV is placed in the heart of your new system.

Photron FASTCAM Viewer 4 - Screen Layout

| | |
|---------------|--|
| LIVE | Control all connected cameras: select recording settings, set camera position, focus, arm and record |
| MEMORY | Display / review captured image sequence held in memory, trim sequence, edit and save images to HDD |
| FILE | Open, display and edit your video files |

The screenshot shows the software interface with several callout boxes:

- Quick Tools:** Zoom / fit, Rotate / mirror, Cross cursor, Multi-lock views, Window alignment.
- Configurations:** Network settings, I/O ports and signal delays, Specific camera settings, Display, Alerts, GUI preferences.
- Tool Menus:** Image adjustment, Measurement, Calibration, Histograms, Crop image, Assistance tools e.g. focus, Lens calibration, Keystone correction, B/G subtraction, Image stabilization.
- Function Bar:** Toggle selected functions on and off.
- Playback Bar:** Display start, current and end frame; Display selected frame count; Display selected video duration; Define save video start / end frame; Enable virtual trigger frame.
- Playback Control:** Play forward / reverse; Step forward / backwards; Set playback speed; Loop, skip playback; Sync by time or frame.
- Function Panels:** LIVE, MEMORY, FILE; Select / edit camera; Set recording conditions; Edit display information; Add comments; Load files; Save / load user settings.

The right-hand side of the interface shows a settings panel for the 'LIVE' mode, including camera selection, frame rate (3000 fps), shutter speed, resolution (1024 x 1024), and fan control options.

Automation and Customization

PFV4 supports a largely automated workflow while maintaining the freedom to customize many features. Various functions are available for this purpose, not limited to:

- Automated file naming
- Automated folder creation
- Automated download
- Customized camera names
- Customized time codes
- Customized test variables



Example:
Following a trigger the camera will autonomously - record, download from memory a preset frame range, increment the file name extension and re-arm.

Software Feedback

PFV provides a clear overview of all configured tools and their status at all times.

They can be easily toggled on and off and edited with a click of the mouse. The displayed images and monitors follow all settings in real time.

- Histogram
- Calibration
- HDR
- Gamma
- Manual Tracking
- Measurement

Function Bar
Enabled functions (black)
Disabled functions (gray)

Image Overlay



Repeatability, Comparability, Clarity

Test series and analyses require good repeatability. The image **Overlay Tool** allows a saved recording from previous tests to be superimposed over the live image. The user can then precisely align the current camera position and magnification to match an earlier test.

By using this tool to overlay and play back a pair of saved videos the user can also easily visualize any subtle differences - measurement tools may also be used.



Live image superimposed on top of saved image.

Over-Exposure Alert

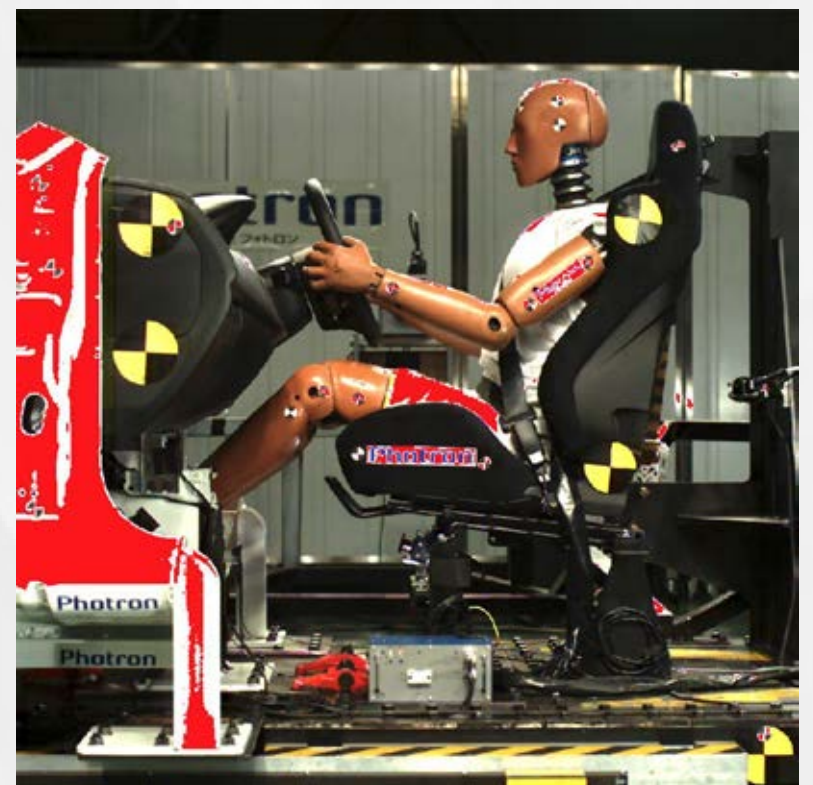


Optimal Exposure

Over-exposure resulting in saturated (white) pixels can easily occur with incorrectly set lens aperture, exposure duration or bad illumination. This leads to a reduction in image information.

Over-exposure may prevent successful post processing or image analysis using tools in PFV or third party software for motion analysis, digital image correlation (DIC) or Particle Image Velocimetry (PIV).

In real time, **Over-Exposure Alert** highlights saturated pixels in red. These highlights disappear as the exposure falls below saturation.



Representation of all overexposed areas in the live image in red.

Focus Assistant



Never miss important details again

In certain conditions, or where a user is inexperienced, it can be difficult to estimate how well the camera is focused on a subject.

The real-time **Focus Assistant** is designed to ensure the best possible focus position, even under unfavorable lighting conditions.

An algorithm calculates and then uses colour to highlight the strength of an edge providing instant visual feedback to the camera operator on focus position.



Reduction of image content to sharp edges.

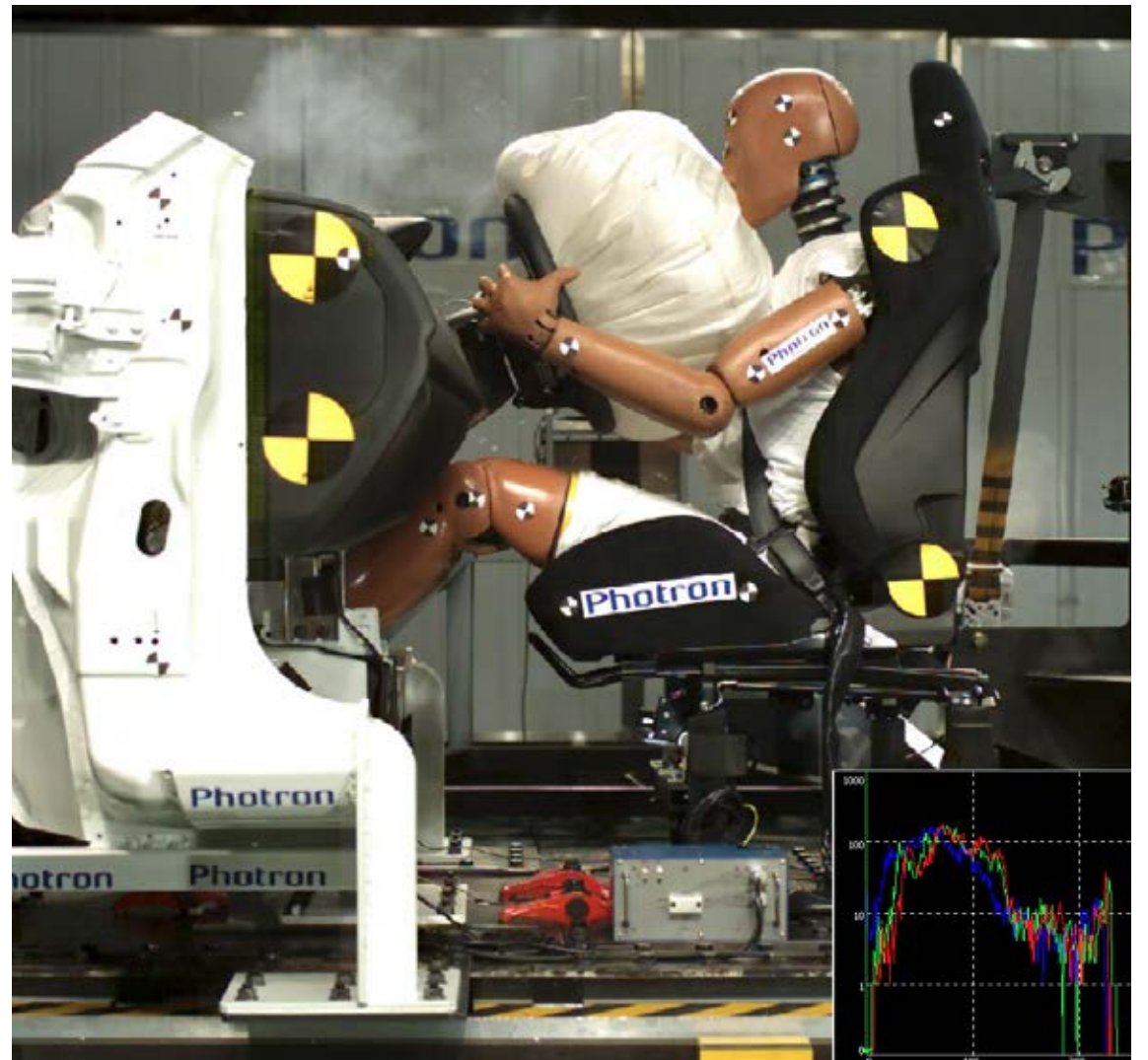
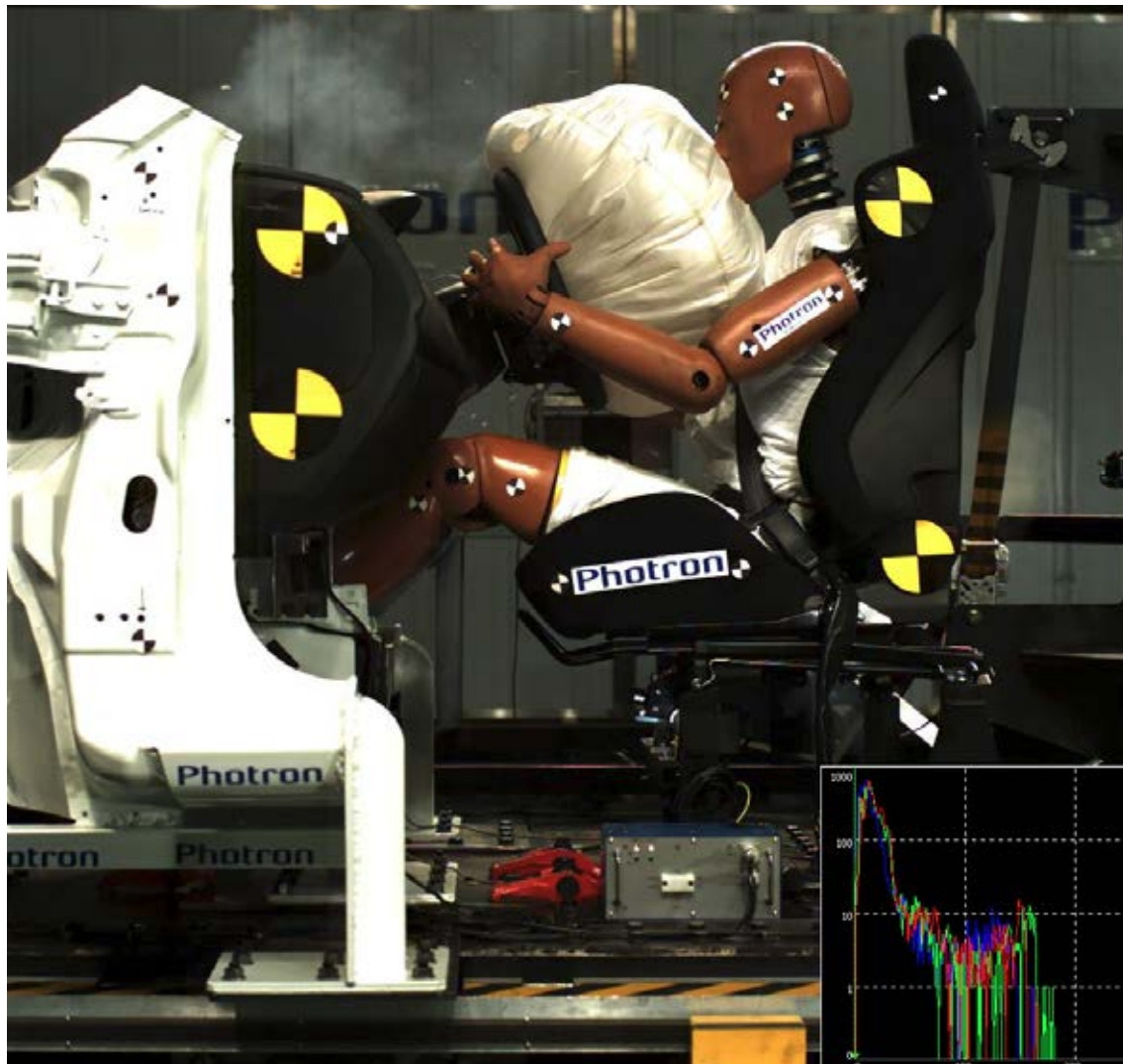
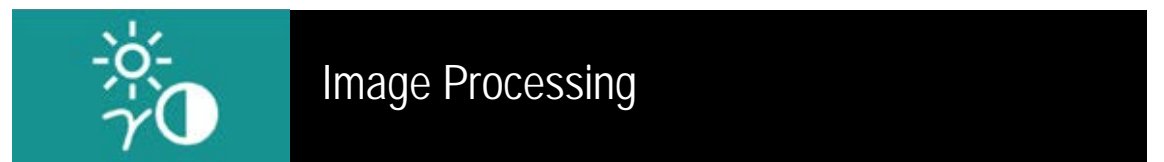


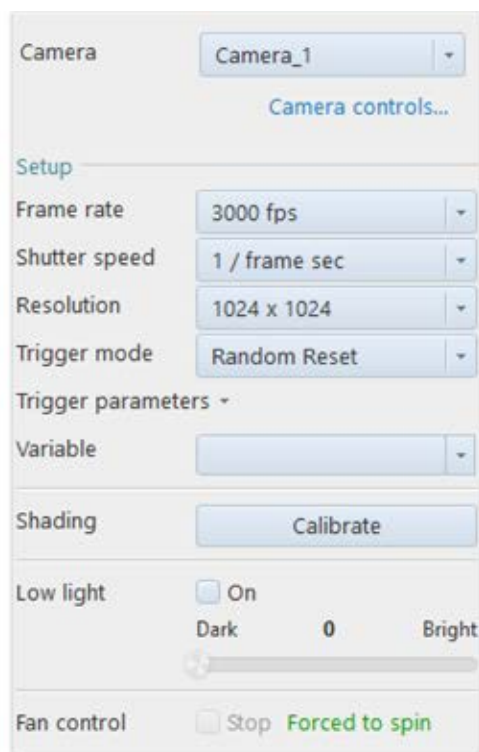
Image enhanced with HDR processing



PFV4 incorporates all of the tools that an operator will need in order to precisely position the camera, set the perfect focus and ensure the ideal exposure prior to image capture.

Implementation of GPU processing ensures smooth “real-time” image adjustment and control of the LUT (Look Up Table), colour correction, filters, pixel binning and HDR (High Dynamic Range) operation.

Camera Setup



Set up all or simply switch between multiple connected Photron high-speed cameras for a range of recording situations.

The **Low Light** feature allows initial camera position and focus to be set or adjusted in ambient light.

Enabling the **Fan Stop** function automatically switches off the camera's cooling fan during recording. This feature makes it possible to avoid vibrations and disrupting air flows for some sensitive measurements such as when working at high magnification.

Assistance Tools

- Synchronisation Assistance
- Image Overlay
- Focus Assistance
- Over-Exposure Alert

Use the **Recording Assistance Tools** to ensure the best possible focus adjustment, camera alignment, prevent overexposure and ensure perfect image composition.

Additional Tools

- Lens Calibration
- Keystone

The **Lens Calibration** and **Keystone** tools remove the effects of lens distortion and camera perspective providing more accurate measurements that appear more natural.

Image Quality Adjustment Tools

- Gain
- Gamma
- Contrast
- Brightness
- High Dynamic Range
- Software Binning
- Color Correction
- Gaussian Filter - Spot Noise Reducer - Median Filter - Edge Enhancement - Zoom Interpolation

Enhance the image with a combination of standard **LUT** tools or customize, save and open user-defined LUT curves.

HDR automatically enhances details in the dark regions of an image and reduces the contrast in brighter regions. HDR is suitable to applications that have both very bright and very dark content such as welding processes, high-voltage discharge or explosive events.

Color Correction offers options for automatic & custom white balance.

Optional **Filters** remove noise, smooth or enhance edges within the image.

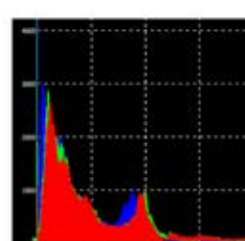
Monitoring Tools

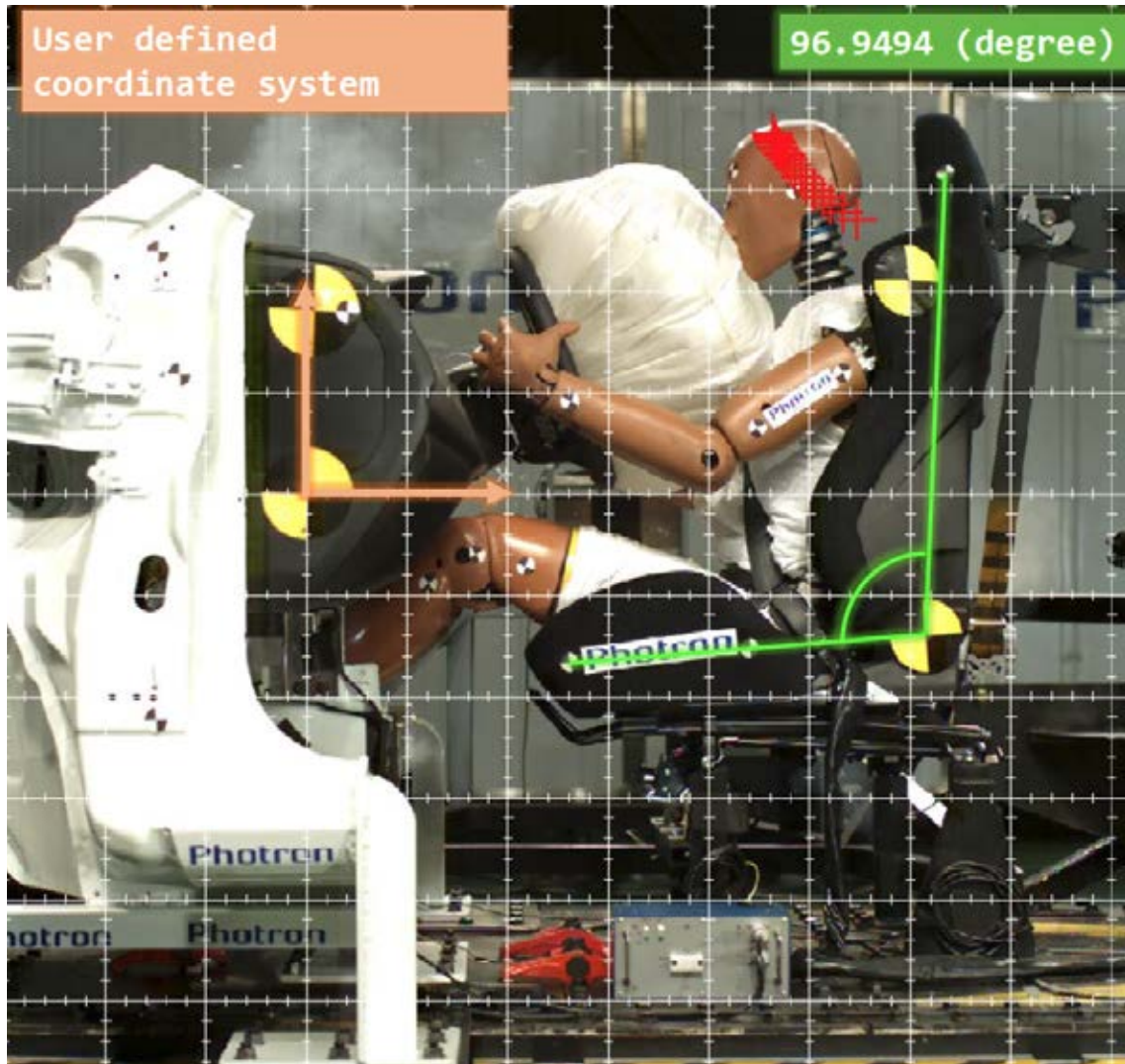
- Pseudo Color
- Histogram
- Line Profile

Monitoring Tools assist the user with correct image composition, lighting and exposure.

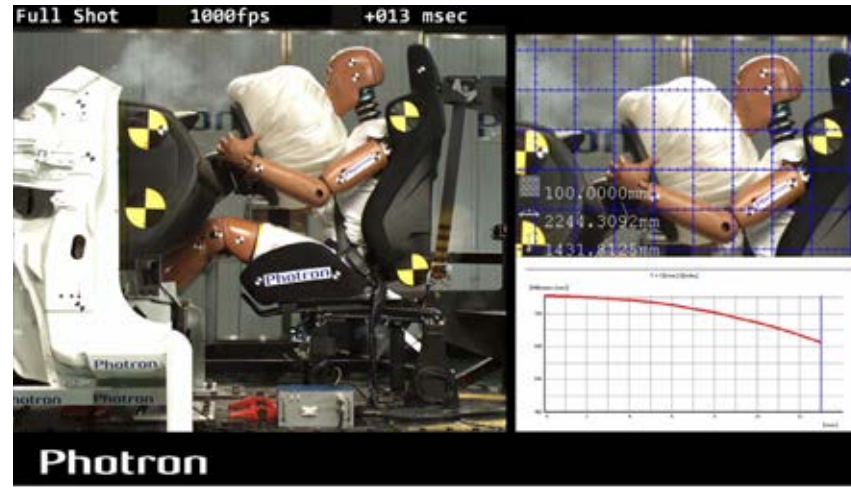
A **Pseudo Color** can be assigned to each grey level within a monochrome image to highlight differences in grey level value.

The **Histogram** tool displays the real-time distribution of RGB or monochrome pixel saturation levels for the current image or the selected region. These values can then be exported to a CSV format file.

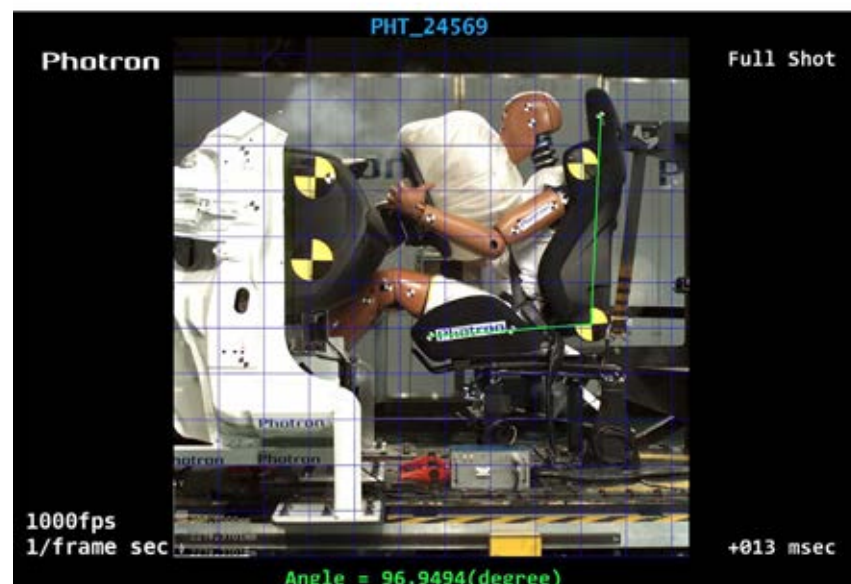




Display calibration grid, custom coordinate system with point tracking and angle measurement.



Layout Save
e.g. Full view and close-up view combined with xt-diagram



Info Save
Video with additional information consisting of measurements, camera settings and test name.

Analysis / Measurement

Incorporating tools for linear calibration, lens distortion and keystone correction, PFV4 provides a wide variety of 2D measurement options to extract quantitative data from the images.

Dimensions Calibration



Apply a linear **Calibration** to the image sequence using SI or USCS units. Options for manual calibration (known pixel size or length) or camera type and magnification.

Options to define a grid overlay and user-defined coordinate system.

Simple Measurement



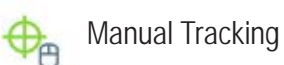
Measure the **Distance** between two points, multiple points or circle centers.

To get a better understanding of rotation, use the 3-point (simple) or 4-point (complex) **Angle** measuring tool.

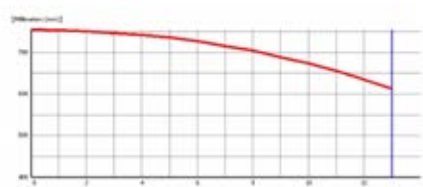
Simple and accurate 3-point determination of circle **Radius** and **Diameter**.

Velocity is automatically reported when selecting an object position separated by two or more frames.

Advanced Measurement



Follow the path of one or several objects over multiple frames by using the **Manual Tracking** tool and record the object coordinates.



Visualise this data as a track of points in the video or displayed as XT or XY graph. Export the raw data to a CSV file or combine the graph and image using **Save Layout** tools.

Export

Providing bespoke tools for compilation and export of high-speed images in a format ready for interpretation, presentation and discussion with colleagues is essential. PFV4 includes tools to combine, stitch and overlay images, graphics, data and text then export to common video formats and generate reports using custom templates for Microsoft® applications.

Save



Sequences can be saved as raw data or with compression to the most common video formats or stills.

Recording settings, test variables, comments and other information are saved with each video and can be rendered directly into the video as an overlay or within a border.

Layout Save



Use layout save to combine a range of content from each test to a single file.

- Layout save supports:
- Multiple camera views
 - Automatic image stitching
 - Dynamic data graph

Report Output



Create unique reports by exporting images and data using custom templates to:

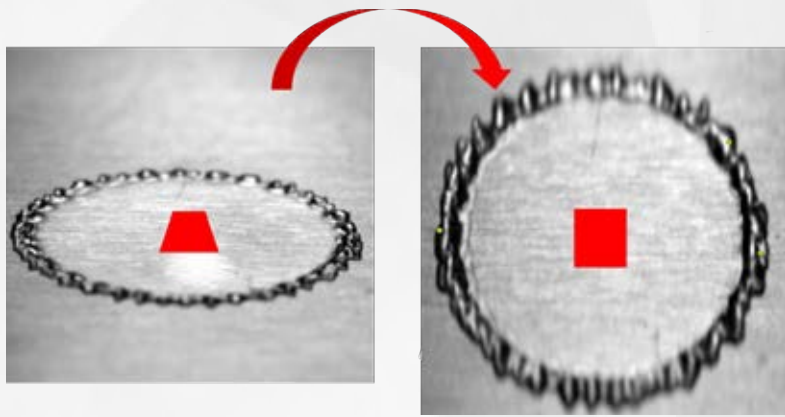
- Microsoft® Excel
- Microsoft® PowerPoint
- Microsoft® Word

Batch Data Converter



Store files from each test quickly in raw format then later using pre-defined save parameters convert in a single step to AVI or other selected file type.

Sample Measurements



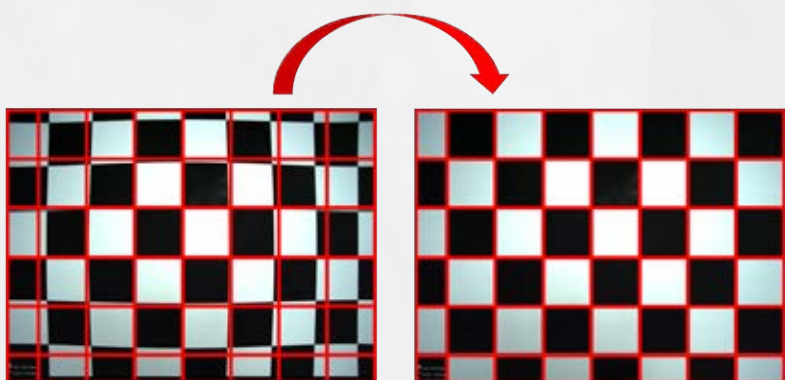
Keystone



Perspective distortion is not an issue

Often the camera cannot be placed perpendicular to the subject resulting in perspective distortion - also referred to as a "keystone" effect. This distortion can be corrected with the **Keystone** function.

After applying keystone correction, measured distances will be more accurate and resulting velocity calculations will also be corrected.



Lens Callibration



Keep it measurable

Theoretically, images can be calibrated with a known scale; in practice however, lenses introduce optical distortion resulting in significant measurement errors – most noticeably when wide angle (short focal length) lenses are used.

PFV4 includes a **Lens Calibration** tool for optical distortion correction to minimize measurement errors.

Utilising the supplied checkerboard template, the semi-automatic lens calibration tool generates a lens correction file. When applied the image distortion is removed and a corrected image displayed.



Stabilization and Trimming



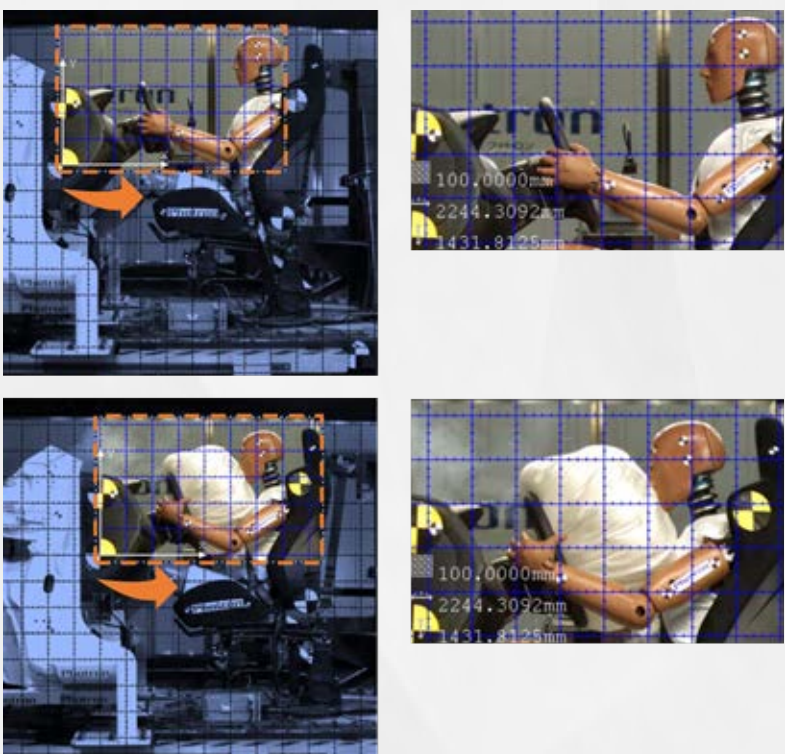
Keep track of your focus

Visually interpreting properties associated with a moving object can be difficult.

With **Stabilization**, any moving object can be fixed in position such that the background moves passed it.

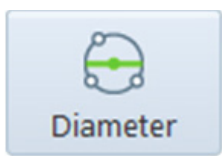
The stabilisation tool utilises a tracking algorithm to automatically follow an object. When the processing is applied and the sequence replayed, the object remains static highlighting the relative motion of features on or around it.

The trimming tool can be used to crop the image to the object area such that the motion of the background is not a distraction.



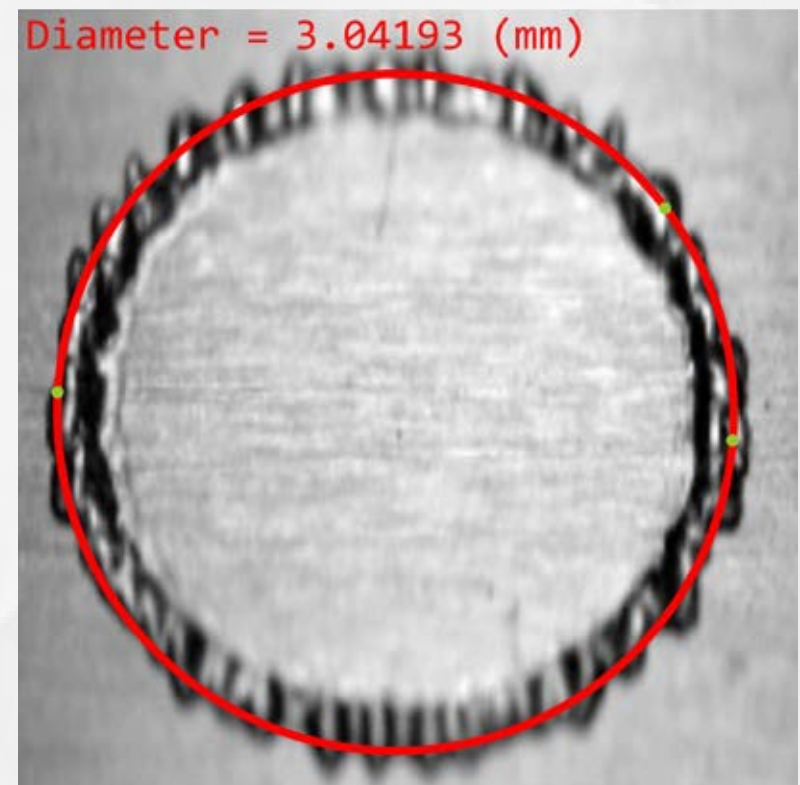
The stabilization tool can also subtract an object's rotation aligning vertically or horizontally.

Perspective distortion is not an issue

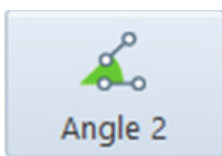


An understanding of fast droplet impact behaviour is key for many applications e.g. IC engines, agricultural spray systems, ink-jet printing. Through the study of micro-scale droplet impact on different substrates these mechanisms can be better understood and impact processes improved.

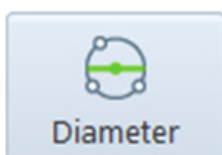
One aspect of these investigations is the maximum expansion during drop impact. The **diameter measuring** tool allows the diameter to be determined at the time of maximum expansion. If a perpendicular view of the surface is not possible, the keystone tool can correct the perspective distortion of the video such that an accurate measurement of size and shape is possible.



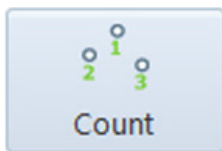
Spray atomisation - Geometry of the spray cone



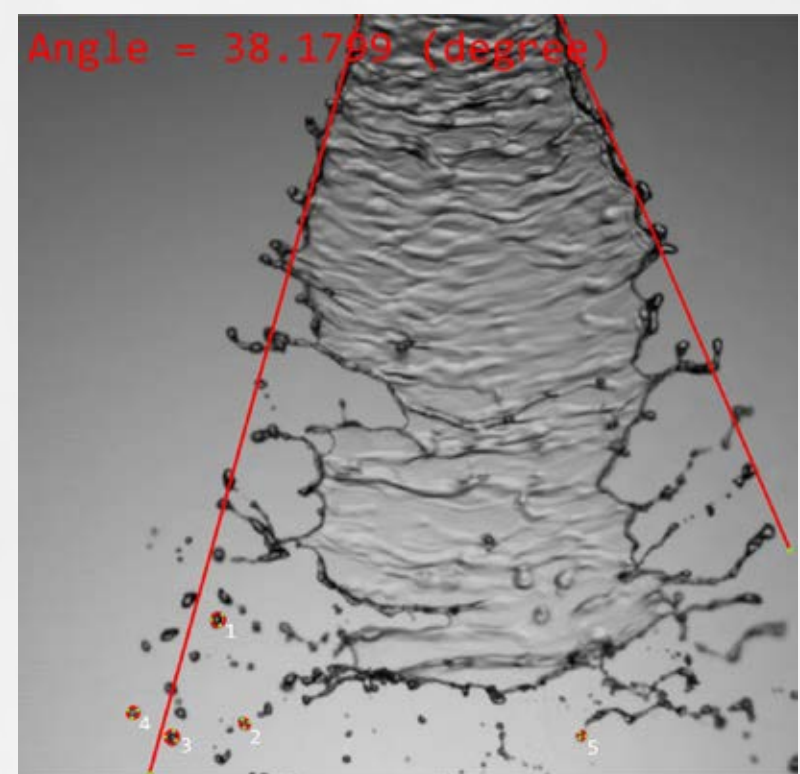
Angle: The determination of spray cone angle and pattern is of interest for the development of drug delivery devices, fuel sprays, agricultural sprays etc. High-speed visualisation is therefore a useful tool to gain a detailed view of this important phenomena. With the 4-point angle measuring tool, one segment of the spray cone is sufficient to obtain the cone angle.



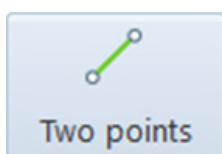
Diameter: Spray pattern and droplet size can also be determined by using the diameter measuring tool.



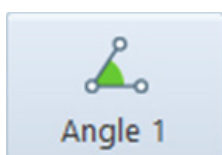
Number: The droplet number and position may also be reported using the count tool.



Ballistics - Velocimetry and pressure wave angle

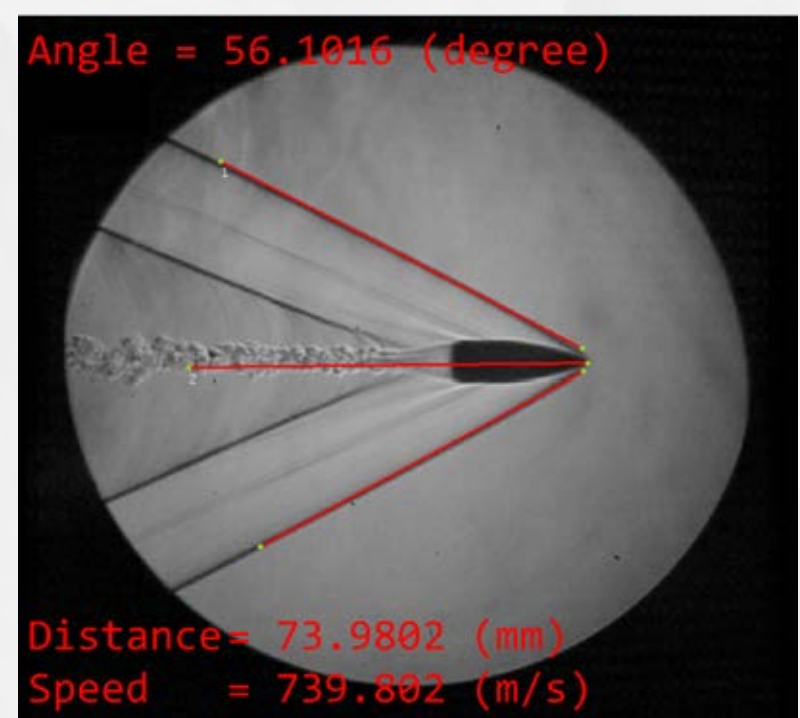


The simple **two point distance** measurement tool is also suitable for the determination of speed. Select a common reference point with one or more frames separation.



In the current example, a displacement of 73.9802 mm was measured over a timeframe of 0.1 ms and the corresponding velocity of 739.802 m/s was calculated.

Beside the speed measurement two different **angle measurement** types are available. If no vertex is visible or present, the 4-point angle measurement is especially useful. This type of measurement only requires the boundary positions to be marked.



Automotive - Visualization of head rebound



Manual Tracking: Dummy head rebound motion is of interest during sled tests. You can visualize the path of the head during impact using manual tracking. Tracked points can be plotted on an XT or XY graph that is dynamically linked to the video thus significantly increasing the informative value of the test.

In addition, the x and y coordinates of tracked points may be exported to a CSV (comma separated values) file, for additional processing and analysis.



PFV Mobile

Set initial recording parameters and focus via tablet device (requires Wireless AP)

PFA (Photron FASTCAM Analysis)

2D automated tracking of up to 5 points

DAQ Plug-In

Integrated support for National Instruments USB DAQ devices .

Compatible with NI USB 6356, NI USB 6361, NI USB 6363, NI USB 6366



General Specifications

| | | | |
|-------------------------|--|-------------------------|--|
| Compatibility | FASTCAM Nova FASTCAM Mini AX / UX / WX / CX FASTCAM SA-Z, SA X2, SA1.1 / SA4 / SA5 / SA6 / SA2 / SA3 / SA7/ SA8 FASTCAM MC2.1 / MH6 / Multi | Image Formats | AVI, MP4, MOV, BMP, TIFF, PNG, JPEG, RAWW, MRAW |
| Language Support | English, French, German, Japanese, Chinese | Supported Codecs | H.264, MJPEG, MJPEG2, PEG4, HuffYUV |
| Units | SI (µm, mm, m, µm/s, mm/s, m/s, km/s, km/h) USCS (in, ft, yd, in/s, ft/s, yd/s, mph) Degrees, Radians sec, ms, µs, ns | Other Formats | CSV (Histogram, Data Acquisition , Manual Tracking), Waveform Data (Data Acquisition) Report Files (Microsoft® Powerpoint , Word, Excel) ISO-MME Camera Setup File, Support File |
| SDK | LabVIEW, MATLAB, SDK (Visual C++) | | |



System Requirements

| | | | |
|-------------------------|---|---------------------------|---|
| Operating System | Microsoft® Windows 10 Pro, Windows 10 Enterprise Microsoft® Windows 10 Education Microsoft® Windows 8.1 Pro, Windows 8.1 Enterprise, Windows 8.1, Microsoft® Windows 7 Ultimate SP1, Windows 7 Enterprise SP1, Microsoft® Windows 7 Professional SP1, Windows 7 Home Premium SP1 64-bit versions are recommended | Graphics Card | 1 GB of Intel® HD Graphics VRAM minimum (NVIDIA® graphics card with 6 GB or higher is recommended) OpenGL2.0 or higher is essential AMD graphics card is not supported More video memory is required when connecting multiple cameras |
| Processor | Intel® Core i5™ or higher (Intel® Core i7™ or higher recommended) *SSE2 is essential | Display Resolution | 24-bit color or higher of WXGA (1,280 x 768) 24-bit color or higher of Full HD (1,920 x 1,080) recommended |
| RAM | 4 GB RAM minimum (above 8GB RAM recommended) | Others | A high capacity hard disk or removable media drive for saving recorded image data A DVD ROM drive for installation When using the Gigabit Ethernet connection, a 1000Base-T capable NIC with “Jumbo Frame” support is recommended. SD Card Reader for playing back images saved on SD Card USB Port for controlling a camera or playing back images saved in a FAST Drive via USB Depending on the image to display, better operating environment than is recommended might be required. |
| Hard Disk or SSD | 1 GB hard disk space for program installation | | |

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