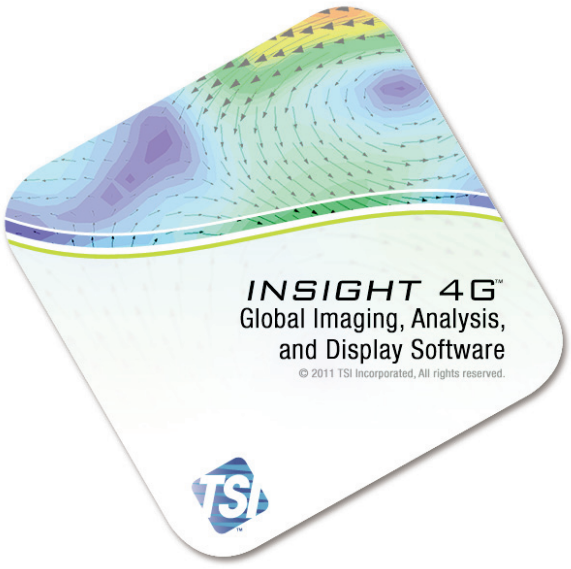
INSIGHT 4G™



INSIGHT 4G™ Global Image Acquisition, Analysis and Display Software improves on the legacy established by the industry-known ***INSIGHT*** software package by TSI Incorporated. Faster, more robust, and with added capabilities, ***INSIGHT 4G*** is a complete PIV software platform operating on Windows® 7 64-bit operating systems capable of controlling a wide range of hardware and quickly analyzing results.

INSIGHT 4G contains full hardware control from the user interface, meaning that once the hardware is turned on, image capture synchronization is controlled completely through the software. In addition, to hardware control, ***INSIGHT 4G*** performs all types of velocity analysis with the latest state-of-the-art algorithms for 2D PIV, PTV, StereoPIV, TSI-patented MicroPIV, as well as size shape analysis (SSA), global sizing velocimetry (GSV), and spray patternation analysis.

Capabilities

Included In The Standard 2D PIV Module:
Particle Image Velocimetry (PIV)

Time-Resolved PIV
- High speed, high repetition rate PIV for capturing the temporal evolution of structures within a flow.
- Cross-correlation image analysis method for achieving velocity fields in a planar region of a flow.

Off-Axis PIV
- Image-dewarping PIV performed with the camera at an angle to the light sheet, used for situations where the 90° camera angle is not possible, or does not give sufficient light scattering.

Super Resolution Particle Velocimetry (SRPV)
- TSI's particle tracking algorithm combines the best features of PIV and particle tracking to obtain vector fields with the highest possible spatial resolution. (Keane et al. 1995)

MicroPIV
- Patented technology licensed by TSI from its inventors for the measurement of velocity in flows at the micron scale.

StereoPIV Module: StereoPIV
- Two-camera PIV allowing measurement of three-dimensional velocity in a planar region of the flow. (Soloff, et al. 1997 and Bjorkquist, 1998)
- Autocalibration for geometric correction of Stereo PIV calibrations (Bjorkquist, 2002)

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Capabilities Continued

Size Shape Analysis (SSA) Module

- Imaging technique that measures the size, shape, and velocity of particles or objects.

Global Sizing Velocimetry (GSV) Module

- Interferometric technique for measuring the diameter and velocity of transparent droplets.

Spray Characterization

- Optical technique for characterizing the global geometric properties of a spray, such as spray angle and patternation.

Planar Laser Induced Fluorescence (PLIF) Module

- Fluorescence technique for measuring scalar quantities in a flow such as pH, temperature, and species concentration.

Image Capture and Hardware Control

Hardware Control

- Full camera control for a variety of CCD and CMOS cameras used for both low and high speed cameras for image straddling, fluorescence, backlighting, interferometry, etc.
- Capture capabilities for simultaneous PIV-PLIF
- Area of interest capture for reduced image size
- Full laser control for Nd:YAG and Nd:YLF lasers for low and high repetition rates

Additional Hardward Control

- Laser pulse energy meter, up to 6-axis traverse control and IO board for external data.
- External triggering for synchronization with your experiment

Data Management

- Open access to data. Image output in raw TIFF format (no image 'compression') and vector output in ASCII text, stored in standard Windows™ directories, no proprietary formats. Full and simple access to all data, no 'data export' required.
- Distributed processing for utilizing multiple computers for processing large datasets. Included in standard ***INSIGHT 4G***, no additional 'upgrade' required.
- Straightforward image calibration
- Software easily upgradeable from 2D PIV to any of the other processing modules

Image Processing Capabilities

Image Pre-Processing

- Simple, visual macro programming of image pre-processing steps
- Background removal in one step
- Image masking
- Image pre-processing routines for phase separation
- Algebraic operations including addition, subtraction, multiplication, division, grayscale inversion, rotation, and masking
- Image binning
- Image filtering (with user-variable kernel parameters) including Guassian, LaPlacian, LaPlaician of Gaussian, local mean, local median, local range
- Image generation from a sequence, such as minimum, average, or maximum intensity
- Image deformation including cardinal, bilinear, bicubic, and nearest neighbor, with user-selectable windowing methods (Hamming, Blackman, Hann, Flat-Top).

PIV Processing

- Grid Engines including Nyquist and deformation grids
- User selectable interrogation spot sizes for both primary and final spots
- Spot mask engines including Gaussian Mask, Zero Pad Mask, and No Mask
- Correlation engines including Direct Correlation, FFT Correlation, and TSI-patented Hart Correlation (Hart, 1999)
- Standard and advanced processors such as Deformation Processor, Rohaly-Hart Processor, Ensemble Correlation, and Double Correlation (Keane, Adrian 1990 and 1992) (Keane et al., 1995) (Wereley, Meinhart, 2000 and Wereley, Gui, 2003)
- Complete access to relevant processing parameters for each processor such as pixel shift, number of passes, SNR ratio, minimum average spot intensity, and more
- Multithreaded processors for utilizing all computer cores
- Distributed processing for utilizing multiple computers
- Particle Tracking Velocimetry (PTV) included with standard ***INSIGHT 4G***
- Dynamic correlation peak analysis for SNR, maximum displacement, and second peak substitution

PIV Post Processing

- Global Velocity validation including absolute max/min range velocity, standard deviation with user-defined tolerances
- Local velocity validation including Median Test, Mean Test, and Universal Median Test, with user-defined neighborhood size and tolerance
- Optional bad vector replacement by secondary correlation peak, local mean or local median
- Vector conditioning (low pass filtering) of velocity fields with user defined Gaussian filter with user defined size and sigma
- Simple, visual macro programming of post-processing steps

PLIF Processing

- Temperature, concentration, pH, species, and other scalar measurement capabilities
- Combustion PLIF processing
- Simultaneous PIV-PLIF measurement and analysis capability
- In-situ calibration method correcting for spurious background signals, noise, spatial and temporal variability in illumination, and variability in individual pixel response
- Ratiometric, linear fit, or user-defined processing methods
- Available correction for laser pulse to pulse variation
- Laser attenuation correction
- Background image removal

SSA Processing

- Determines pixel size of particles including: diameter, circularity, center of mass, area, Feret's diameter, perimeter, etc…
- Tracks particles in space for determination of the velocity
- Subranging for phase separation analysis

GSV Processing

- FFT analysis of interference fringe pattern for determining droplet diameters from 10 to 500 microns
- Fringe tracking allows determination of velocity

Super Resolution Particle Velocimetry Processing

- Particle identification and tracking
- Utilizes PIV correlation as a 'first guess' in obtaining particle-resolved velocities
- Highest possible spatial resolution through the determination of individual particle velocities
- Gives particle image size and associated statistical properties

Data Display and Statistics

TecPlot

- Free copy of TecPlot Focus included with every copy of ***INSIGHT 4G***
- Extensive data display options including contouring, streamlines, vectors, shading, translucency, data normalization (non-dimensionalizing the data), reference velocity field subtraction (e.g. subtract average field), etc…
- Higher order statistical analysis such as mean, standard deviation, turbulence intensity, Reynolds stresses, velocity gradients, vorticity, strain rate, etc…
- Vector/Contour plots, scatter plots, histograms
- Movie/animation generation
- User-defined variables

MATLAB Dynamic Runtime

- MATLAB Runtime included with every copy of ***INSIGHT 4G***
- Time and spatial analysis for analyzing time-series velocity data, correlation, spectra, and Fourier series analysis
- Proper Orthogonal Decomposition (POD) analysis for extracting major/minor features of the flow
- Statistical analysis such as mean, standard deviation, turbulence intensity, Reynolds stresses, velocity gradients, vorticity, strain rate, dissipation, etc…
- Movie/animation generation
- Vector/Contour plots

INSIGHT 4G™

TSI serves the Global Gluid Flow Research community, through our direct offices and channel partners; TSI is committed to providing the lightest quality products.

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