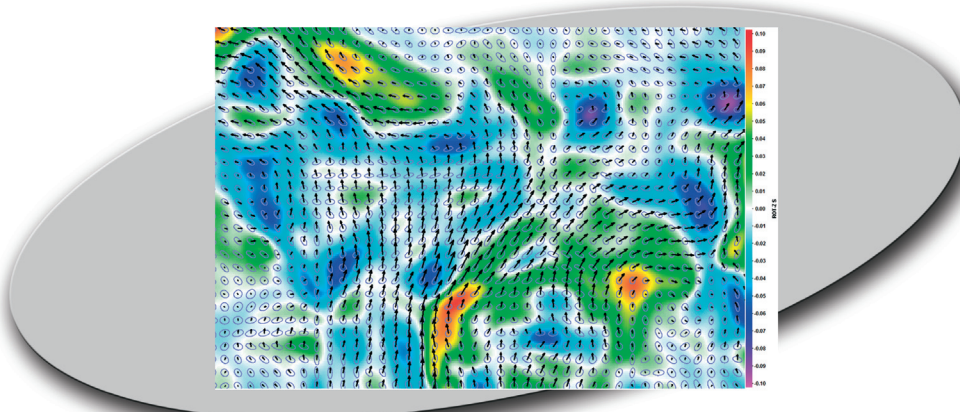


## Adaptive PIV

automatic optimization of  
recording and processing  
parameters

So far it always requires considerable user knowledge and experience to choose optimal recording parameters and to select appropriate processing parameters – especially interrogation window size - to balance robustness, accuracy and effective spatial resolution of calculated flow fields. In addition such constant global settings are never optimal for all regions within the field-of-view due to local variation of seeding density, image quality, and flow conditions.

LaVision's new **Adaptive PIV** technology now provides an automatic calculation of the optimal local interrogation window size and shape based on flow gradients ('flow adaptivity') and image quality ('signal adaptivity'). This leads to a significant improvement in accuracy and spatial resolution, especially in regions of high flow gradients, e.g. close to walls.



### Advantages

- ▶ improved spatial resolution, accuracy and speed
- ▶ self-adapting local interrogation window size and shape
- ▶ control of image focus, brightness, seeding density and dt
- ▶ user friendly: automatic determination of optimal parameters

### Optimal recording parameters

LaVision's FlowMaster system determines on-the-fly the local seeding density, image contrast/ dynamic range and maximum displacement to provide a valuable feedback to the user during the experimental setup. The time separation between the two laser pulses can be automatically optimized.

### Optimal interrogation window size and shape

The interrogation window size is based on a combination from the magnitude of the flow gradient and the correlation value which reflects variations in seeding density, image quality, out-of-plane motion, etc. In regions of strong gradients like vortices smaller windows are appropriate, while lower seeding density and strong out-of-plane motion require larger windows. In addition elongated window shapes perpendicular to the direction of the strongest gradient are used to enhance the spatial resolution in one direction relative to the one perpendicular while maintaining the same number of pixels and therefore vector accuracy. This is particularly important for high shear regions along flow boundaries where the interrogation windows are automatically aligned along the boundary. While the window size and shape selection is fully automatic and does not require any tedious user definition – not feasible for time-varying flow fields - the range of interrogation window sizes and the degree of adaptivity can be user defined.

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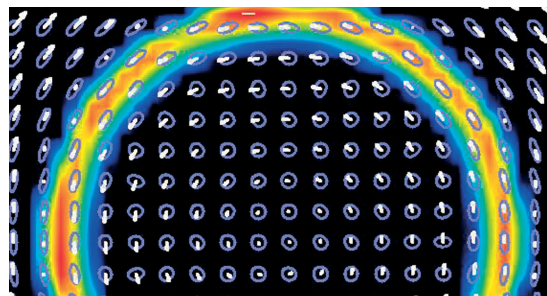
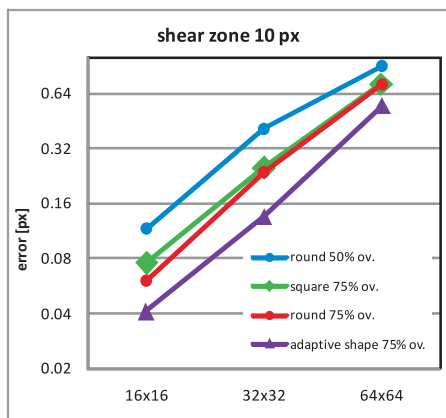
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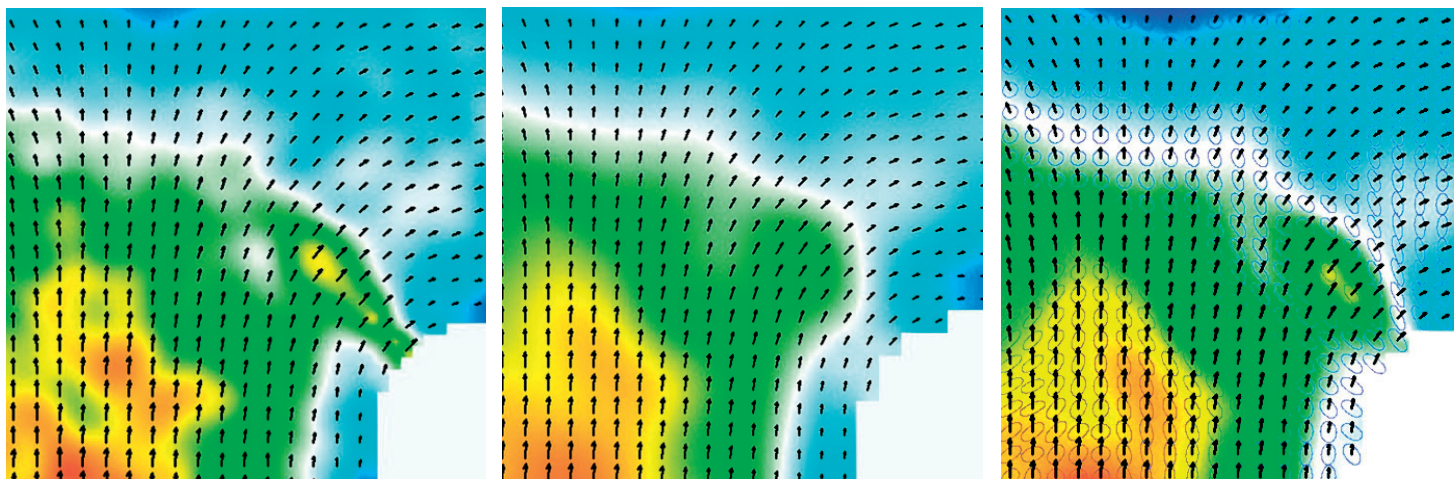
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Advantage of **Adaptive PIV** shown for synthetic data: less error with adapted smaller and elongated windows

## Availability

LaVision's **Adaptive PIV** is available in **DAVIS 8** for standard planar 2D- and Stereo-PIV as well as for the multi-pass 2D/ Stereo ensemble-averaging approach (see Theunissen et.al. 2010) as shown below for a typical  $\mu$ PIV-experiment.



**Ensemble correlation:** left:  $16^2$  ov. 75%, middle:  $32^2$  ov. 75%, right: **Adaptive PIV** with  $32^2$  ov. 75% detecting small flow features with  $16^2$  window sizes while maintain the accuracy of  $32^2$  windows in other regions.

## References

- Wieneke B, Pfeiffer K, Adaptive PIV with variable interrogation window size and shape, 15th Int.Symp. Laser Appl Fl. Mech., Lisbon, Portugal, July 2010.
- Theunissen R, Scarano F and Riethmuller ML, An adaptive sampling and windowing interrogation method in PIV, Meas.Sc.Techn., 18:275-287, 2007.
- Theunissen R, Scarano F and Riethmuller ML, On improvement of PIV interrogation near stationary interfaces, Exp.Fluids, 45:557-572, 2008.
- Theunissen R, Scarano F and Riethmuller ML, Spatially adaptive PIV interrogation based on data ensemble, Exp.Fluids, 48:875-887, 2010.

Data provided by LaVision are believed to be true. However, no responsibility is assumed for possible inaccuracies or omissions. All data are subject to change without notice.

Jun-10

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