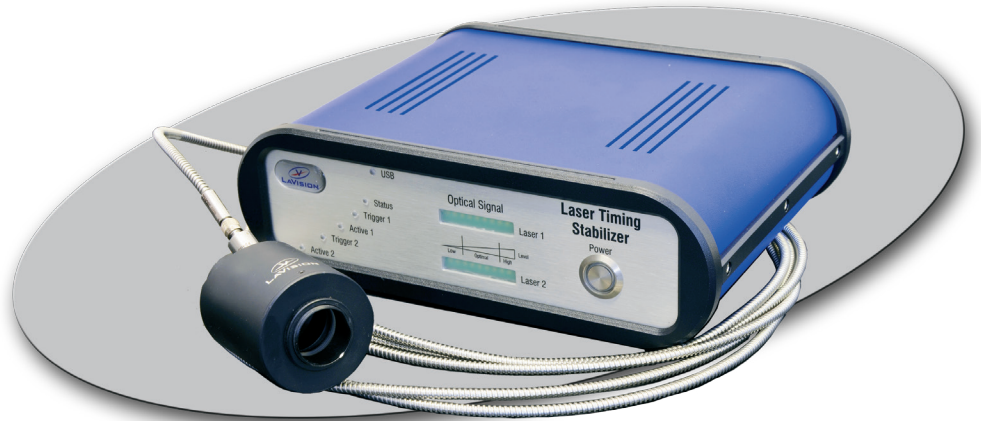# Laser Timing Stabilizer

Add-on device for correcting systematic timing errors of PIV lasers

The **Laser Timing Stabilizer** is a simple add-on device to mitigate the systematic timing errors of PIV lasers. It ensures a precise Δt (i.e. the time separation between the two laser pulses of a PIV laser) with any laser type at any working condition, without affecting the laser beam.
Therefore an important source of uncertainties in the PIV measurement technique can be eliminated.

The **Laser Timing Stabilizer** consists of a fiber coupling mechanics which is mounted directly at the laser exit. A stable optical fiber leads the collected light to a controller where a fast photodiode measures the inherent time separation of the laser pulses.

During a calibration process the controller measures the effective time separation between the external trigger signal (Q-switch trigger coming from the Programmable Timing Unit PTU, for example) and the corresponding laser pulse. The Q-switch trigger is shifted that way to reach a fixed, well-known timing of the released laser pulse. For a PIV double-pulse laser this procedure is applied automatically to both laser cavities so the effective time separation dt is equal to the set value. Systematic timing errors of the laser pulses are eliminated, for a highly accurate PIV result. Additionally, the device is capable to measure residual timing errors which are caused by pulse-to-pulse variations and jitters during the PIV recording.
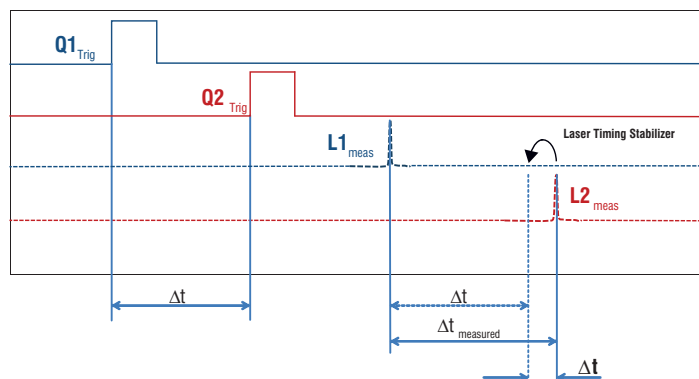
Advantages

▶ highly accurate correction of laser timing delays
▶ real-time measurement possible, for even higher precision
▶ simple add-on hardware component
▶ suitable for any pulsed laser @ 300 - 900 nm

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Features

▶ fully integrated in DaVis software

▶ no adjustments or alignments required

▶ timing correction without influence to the laser beam

▶ upgradeable to existing PIV systems

▶ parts included: controller, optical fiber, fiber coupler

Laser timing measurement for a common Nd:YAG double-pulse PIV laser
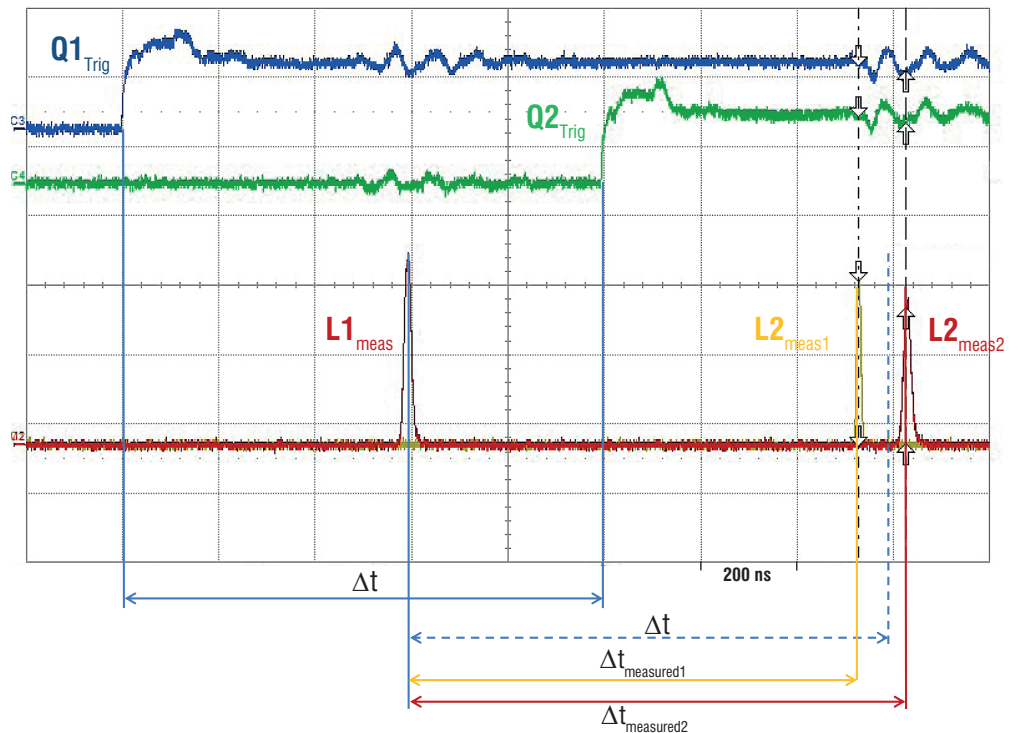
$Q1_{Trig}$: trigger pulse for Q-switch of laser 1

$Q2_{Trig}$: trigger pulse for Q-switch of laser 2

$L1_{meas}$, $L2_{meas1}$, $L2_{meas2}$: measured light pulses of laser 1 and 2 respectively with a photodiode

L1 was operated at max. flashlamp energy and optimal Q-switch delay

L2 with varying flashlamp energy and Q-switch delay