TRUMPF Scientific Lasers: Pump-Seed Synchronization

Machine Tools/Power Tools

Laser Technology/Electronics

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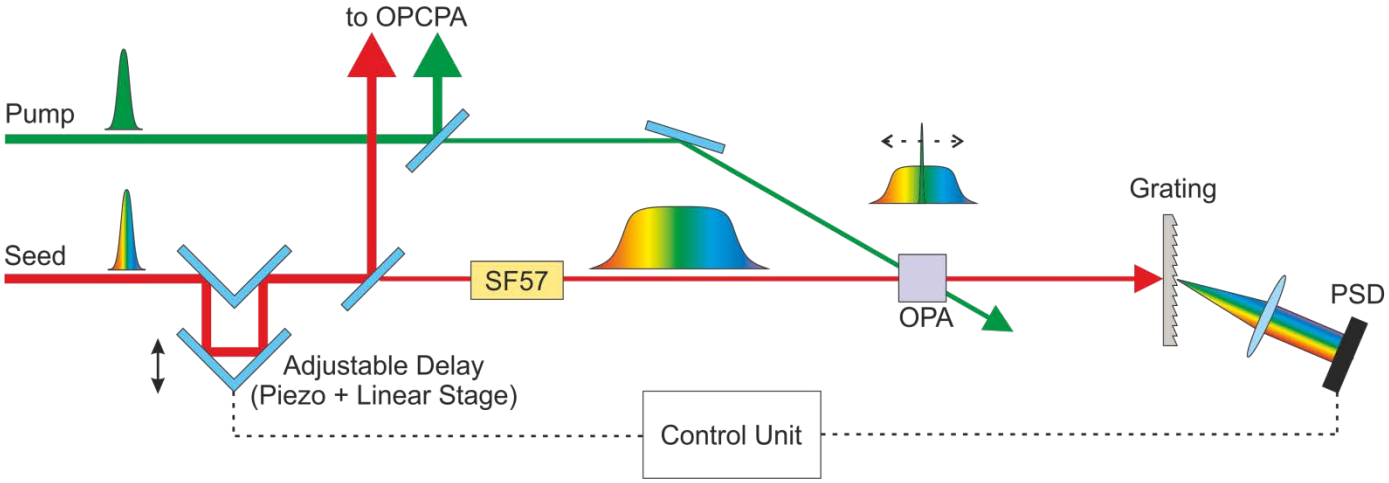
fs-synchronization.

Stable performance of optical parametric chirped pulse amplifiers (OPCPA) require precise spatial and temporal overlap of the interacting pulses. TRUMPF Scientific Lasers has developed an active synchronization system reducing the pump-seed timing jitter below 2 fs . This solution is available as a stand-alone device and can easily be implemented in almost any OPCPA system.

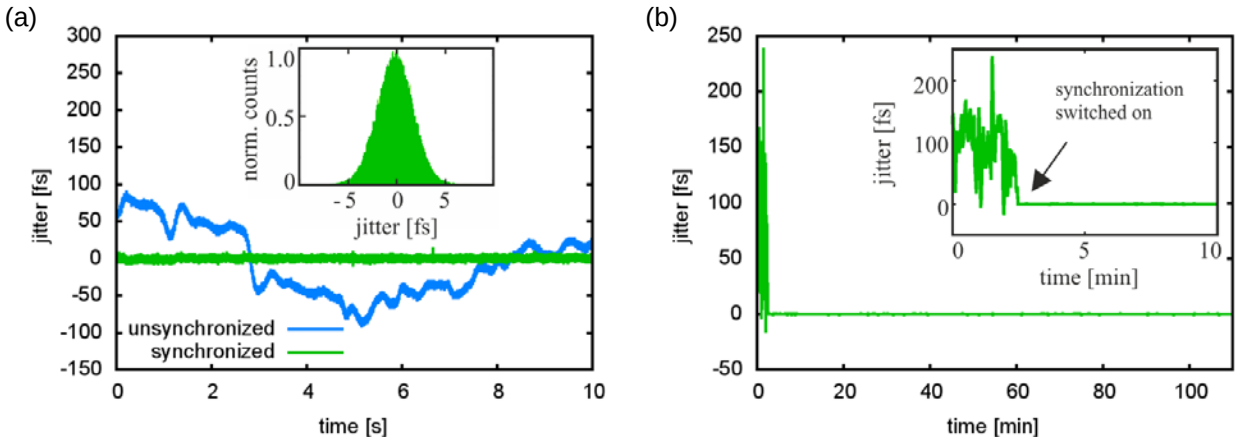


Scheme of the pump-seed-synchronization system. Its principle is based on a spectrally resolved optical parametric amplification. SF57, bulk glass block; DFG, difference frequency generation; PSD, position sensitive detector

Long and short term stabilization.

Setting up an OPCPA system with pump and seed pulse derived from the same source is not a guarantee for perfect synchronization in the OPCPA stages. Slow temporal drifts and fast jitter in the pulse arrival times arise from thermal effects, air turbulences and vibrations resulting in spectral shifts, instable pulse energies, varying pulse durations and reduced efficiencies. The TRUMPF Scientific Lasers active pump-seed synchronization compensates long term drifts, reduces the fast jitter to a minimum and guarantees a stable operation of the OPCPA system.

	fs-synchronization
RMS timing jitter	< 2fs
Max. drift compensation	± 80ps
E_{seed}	> 4pJ
E_{pump}	> 10µJ
Module size	537mm x 267mm x 97mm



(a): Short-term timing jitter without stabilization (blue) and with active stabilization (green). The RMS timing jitter in the stabilized case is reduced to σ < 2 fs. Inset: Jitter deviation. (b): Long-term measurement of the timing delay between the pump and seed pulses. Inset: Switching on of the stabilization.

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