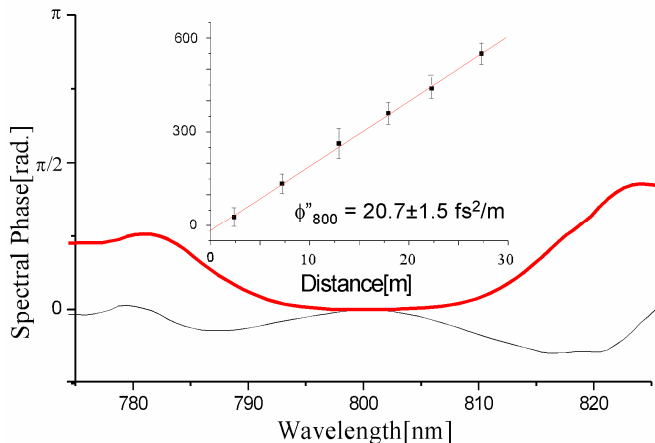


MIIPS™ application notes What can you do with MIIPS™?

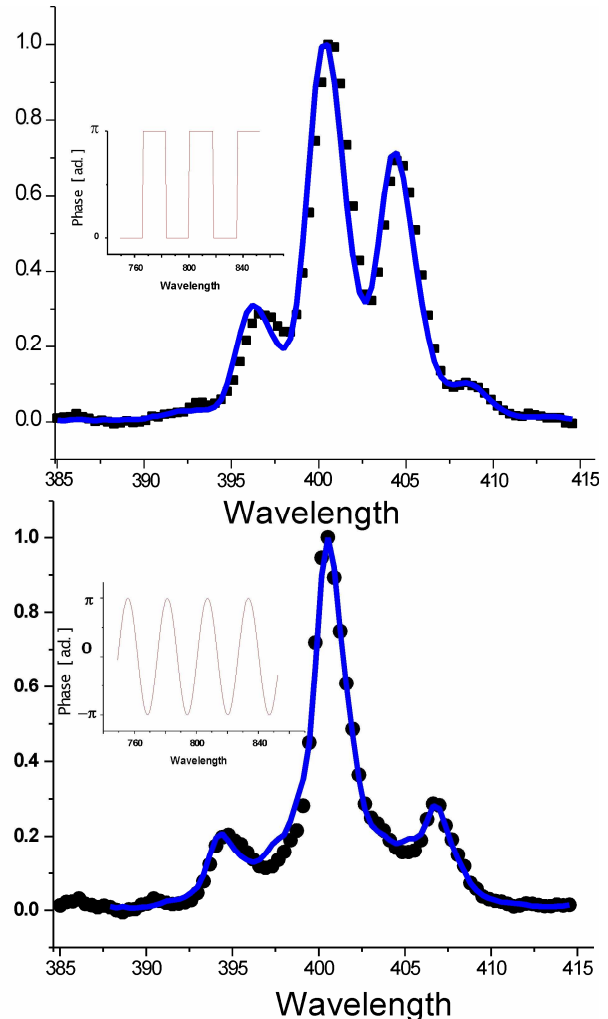
Application of MIIPS™ for standoff detection using femtosecond pulses

There has been a growing interest in standoff detection of chemicals for industrial, environmental and homeland security applications using amplified femtosecond pulses in the last few years. The laser-target interaction is nonlinear in nature and nonlinear optical processes depend on the spectral phase of the pulse. Because the propagation of ultrashort pulses to a remote target causes distance-dependent phase distortions, accurate phase measurements, and spectral phase correction are critical for reproducible measurements based on nonlinear optical excitation. The MIIPS™ method achieves both of these requirements, and is ideal for obtaining reproducible results.



Accumulated phase caused by propagation of femtosecond pulses in air. The red line shows the accumulated phase after the pulse propagates for 30 m. The black line is the phase measured 2.8 m from the amplifier. The inset shows group velocity measurements as a function of distance.

MIIPS™ is a single beam characterization and compensation method that does not depend on beam overlap, interferometry or beam quality. This makes it ideal for standoff applications at tens, hundreds or thousands of meters from the laser. Similarly to all other MIIPS™-enabled applications, the pulse shaper introduces a reference phase to measure the unknown phase distortions in the pulse. It then cancels the distortions by introducing their complement. This procedure has been demonstrated at a distance of 30 m. With MIIPS™, the measurement and elimination of phase distortions was completed within a few seconds. The resulting pulses at the end of the process were within 1% of the transform limit at the remote target.



Frequency doubled spectra of pulses shaped with a square phase function (top) and a sinusoidal phase function (bottom) phase functions. The spectra were recorded at a distance of 2.8 m (blue lines) and 28.9m (black dots). The excellent agreement can only be achieved when the accumulated phase distortions by the beam propagation are cancelled using MIIPS™.

Reference:

I. Pastirk, X. Zhu, R. M. Martin, and M. Dantus, Optics Express 14, 8885-8889 (2006).

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