Single-shot d-scan technique for the temporal characterization of high-power ultrafast laser systems

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We present a novel dispersion-scan (d-scan) [1,2] scheme for single-shot temporal characterization of ultrashort laser pulses. The novelty of this method relies on the use of a highly dispersive crystal featuring antiparallel nonlinear domains with a random distribution and size [2]. This crystal, capable of generating a transverse second-harmonic signal over a very broad phase matching range, acts simultaneously as the dispersive element and the nonlinear medium of the d-scan device. The resulting in-line architecture makes the technique very simple to align and very robust, allowing the acquisition of single-shot d-scan traces in real time [3]. These characteristics make the technique especially well-suited to the characterization of high-power, low repetition rate ultrashort lasers and other systems where pulses can change rapidly from shot-to-shot. In contrast to other single-shot techniques, the beam does not have to be spatially homogeneous, and the diagnostic can be used to measure the pulse at different sampling positions within the beam. Measurements of pulses from a ≈40 fs, 40 TW laser were in very good agreement with independent frequency-resolved optical gating measurements. We also applied the new single-shot d-scan to a TW-class laser equipped with a programmable pulse shaper, obtaining an excellent agreement between the applied and the d-scan retrieved dispersions.

References

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