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Optical comb generation for streak camera calibration for inertial confinement fusion experiments

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Abstract

The National Ignition Facility (NIF) at Lawrence Livermore National Laboratory (LLNL) is coming on-line to support physics experimentation for the U.S. Department of Energy (DOE) programs in Inertial Confinement Fusion (ICF) and Stockpile Stewardship (SS). Optical streak cameras are an integral part of the experimental diagnostics instrumentation at NIF. To accurately reduce streak camera data a highly accurate temporal calibration is required. This article describes a technique for simultaneously generating a precise +/- 2 ps optical marker pulse (fiducial reference) and trains of precisely timed, short-duration optical pulses (so-called “comb” pulse trains) that are suitable for the timing calibrations.

These optical pulse generators are used with the LLNL optical streak cameras. They are small, portable light sources that, in the comb mode, produce a series of temporally short, uniformly spaced optical pulses, using a laser diode source. Comb generators have been produced with pulse-train repetition rates up to 10 GHz at 780 nm, and somewhat lower frequencies at 664 nm. Individual pulses can be as short as 25-ps FWHM. Signal output is via a fiber-optic connector on the front panel of the generator box. The optical signal is transported from comb generator to streak camera through multi-mode, graded-index optical fiber.

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