

Supplementary information: Off-harmonic optical probing of high intensity laser plasma expansion dynamics in solid density hydrogen jets

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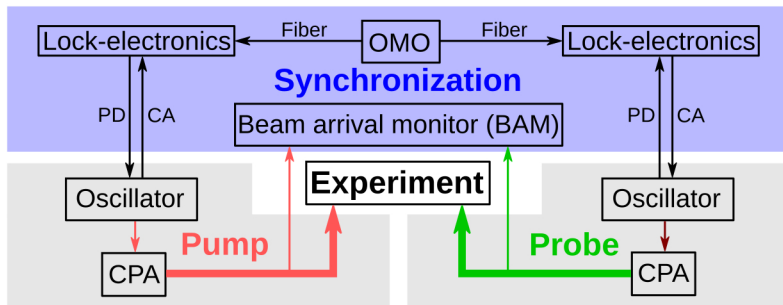
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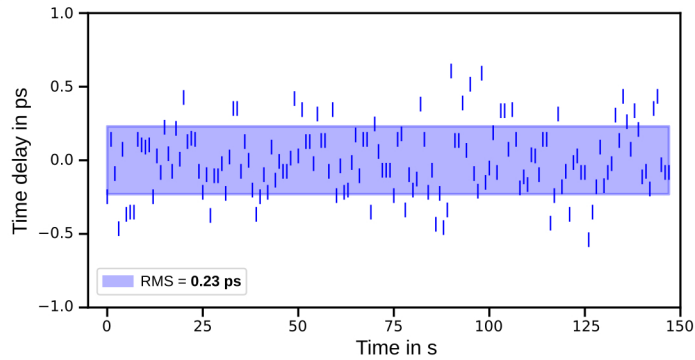
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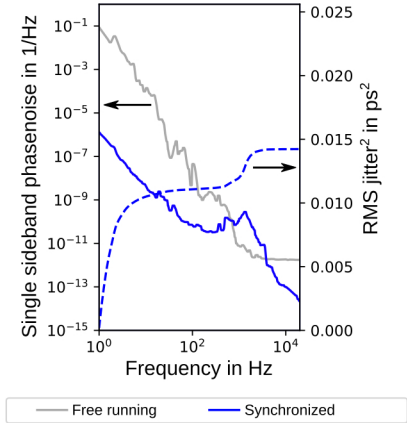
(a)



(b)



(c) Pump oscillator



(d) Probe oscillator

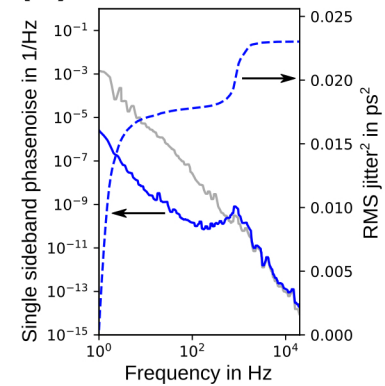


Figure S1. (a) Schematic of synchronization control between pump- and probe laser system, OMO - optical master oscillator, PD - photo diode, CA - cavity adjustment, CPA - chirped pulse amplification; (b) measurement of the shot-to-shot time delay via the beam arrival monitor (BAM), height of the markers gives the error of the BAM measurement; (c),(d) measurement of the single sideband phase noise versus an external clock and the calculated square of the temporal RMS-jitter for (c) pump laser oscillator and (d) probe laser oscillator.

Resolution test chart imaged via experimental setup

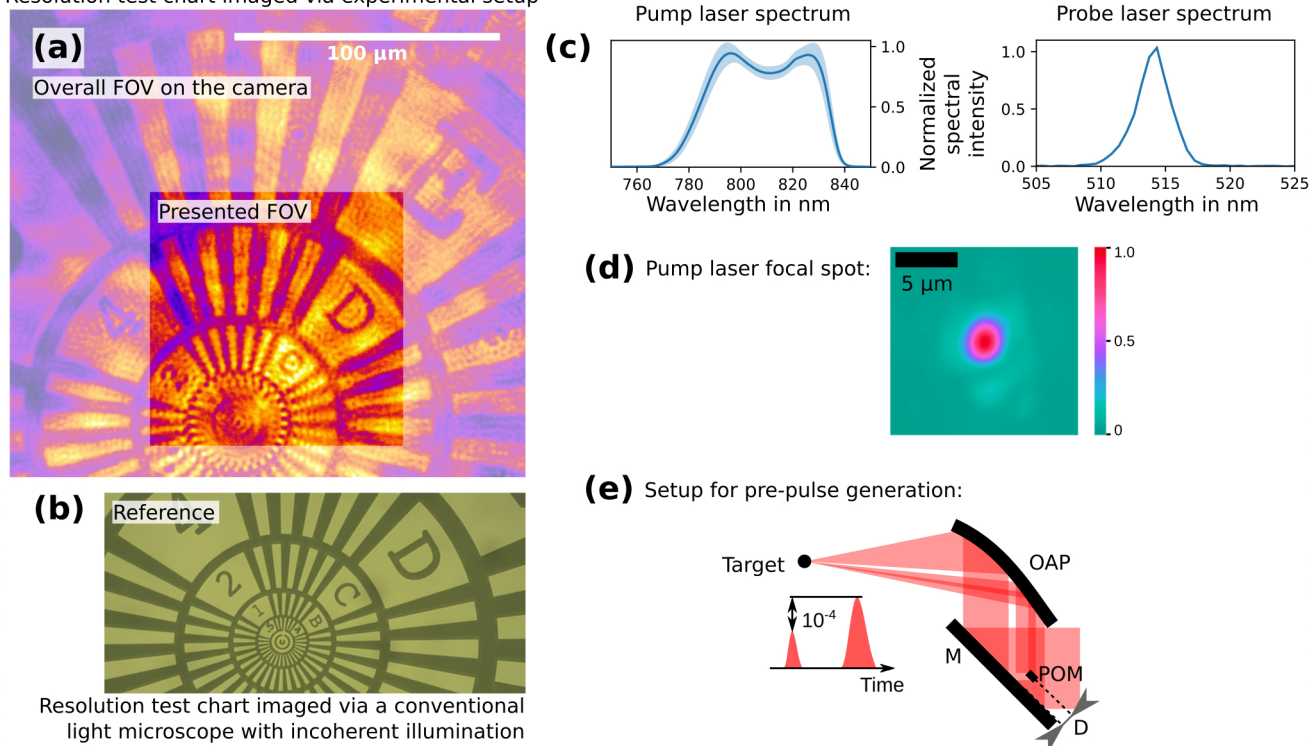


Figure S2. (a) Resolution test chart illuminated by the probe laser and imaged by the optical setup presented in figure 1 of the manuscript. The overall field of view (FOV) on the camera and the presented FOV (figure 3 in the manuscript) is shown. A structure size as small as 1.5 μm is resolved in all directions and no image distortion is visible within the overall FOV. (b) The same resolution test chart imaged by a conventional light microscope in bright-field operation and with incoherent illumination. The spatial scale is equivalent to figure (a). (c) **left:** Spectrum of the fully amplified pump laser beam before compression. The spectrum shows the mean and standard deviation over 37 days of laser operation. (c) **right:** Probe laser spectrum. Reproduction of the “Probe only” spectrum in figure 2 (c) of the manuscript. (d) Pump laser focal spot measured with the attenuated pump laser beam. Instead of the anti-reflection coating of the plasma mirror substrate, a reflective part of the same substrate is used to emulate the reflective plasma mirror surface during a high intensity laser shot. (e) Setup for generation of the −20 ps and −40 ps pre-pulse utilized for the measurements in figure 2 (c) of the manuscript. The pump laser beam with 18 cm beam diameter is reflected by the last folding mirror (M) to the off-axis parabola (OAP) and focused onto the target. A pick-off mirror (POM) with half-inch diameter is inserted before the last folding mirror and generates a pre-pulse with defined delay (D) at 10^{−4} less intensity than the peak of the pump laser pulse.