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Burst shot of the self-injection dynamics of a laser wakefield accelerator in bubble regime

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Ultrafast shadowgraphy with transverse few-cycle probe pulses has enabled the snapshot of the underdense laser-plasma interactions with unprecedented temporal (~ 4 fs) and spatial (< 10 μm) resolution. However, in laser-plasma experiments, the shot-to-shot fluctuation of high-power laser systems is not negligible. This limits the application of snapshot imaging techniques, especially in observing fast-evolving dynamics, such as the lengthening of the bubble induced by pump pulse self-focusing and self-compression. In this research, we are developing a burst shot imaging technique based on ultrafast shadowgraphy. Instead of a Fourier transform limit few-cycle probe pulse, a linearly chirped few-cycle pulse with a duration of ~ 300 fs is used as the probe. After the probe pulse propagates through the microscopic imaging system, three plate beamsplitters are used to create four replicas of the probe. Each replica is independently recorded by a CCD camera with a 10 nm narrow bandpass filter (BPF) to recover the temporal resolution of the shadowgram. The BPFs in front of the different cameras have different central wavelengths. As a result, the shadowgrams recorded by different cameras correspond to different delays between the main pulse. Some preliminary results are presented in this poster.

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