

Supplementary Materials for

A laser-plasma accelerator driven by two-color relativistic femtosecond laser pulses

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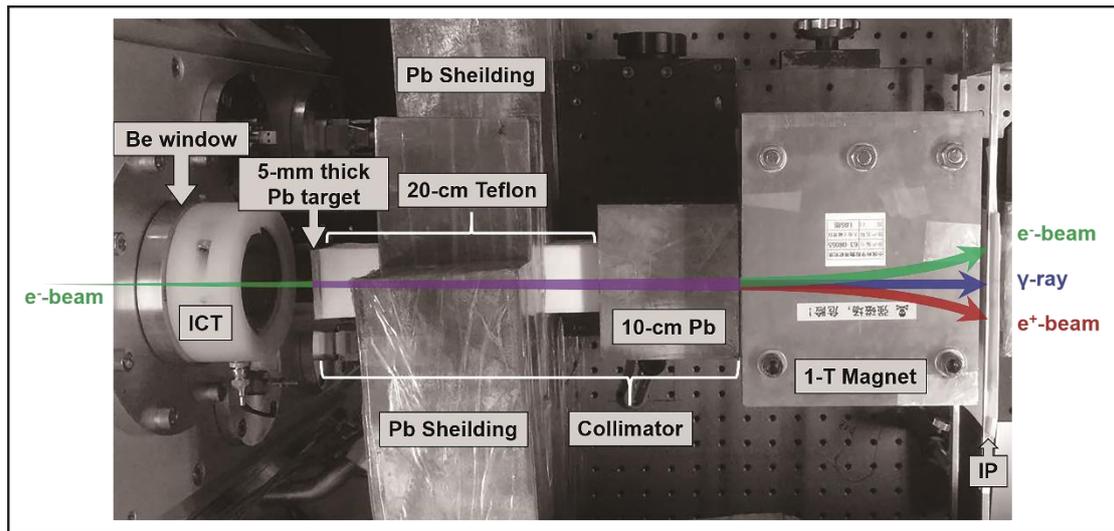


Fig. S1. A top-view photograph of the experimental setup used for the generation of positron beams based on the LWFA. A 5-mm thick Pb block was used as a converter for the generation of the positrons, followed by a 30-cm long collimator (with 1-cm diameter) composed of Teflon and lead, followed by a 1-T 16-cm long magnet (gap of 2 cm) which is then followed by the IP (image plate) detector.

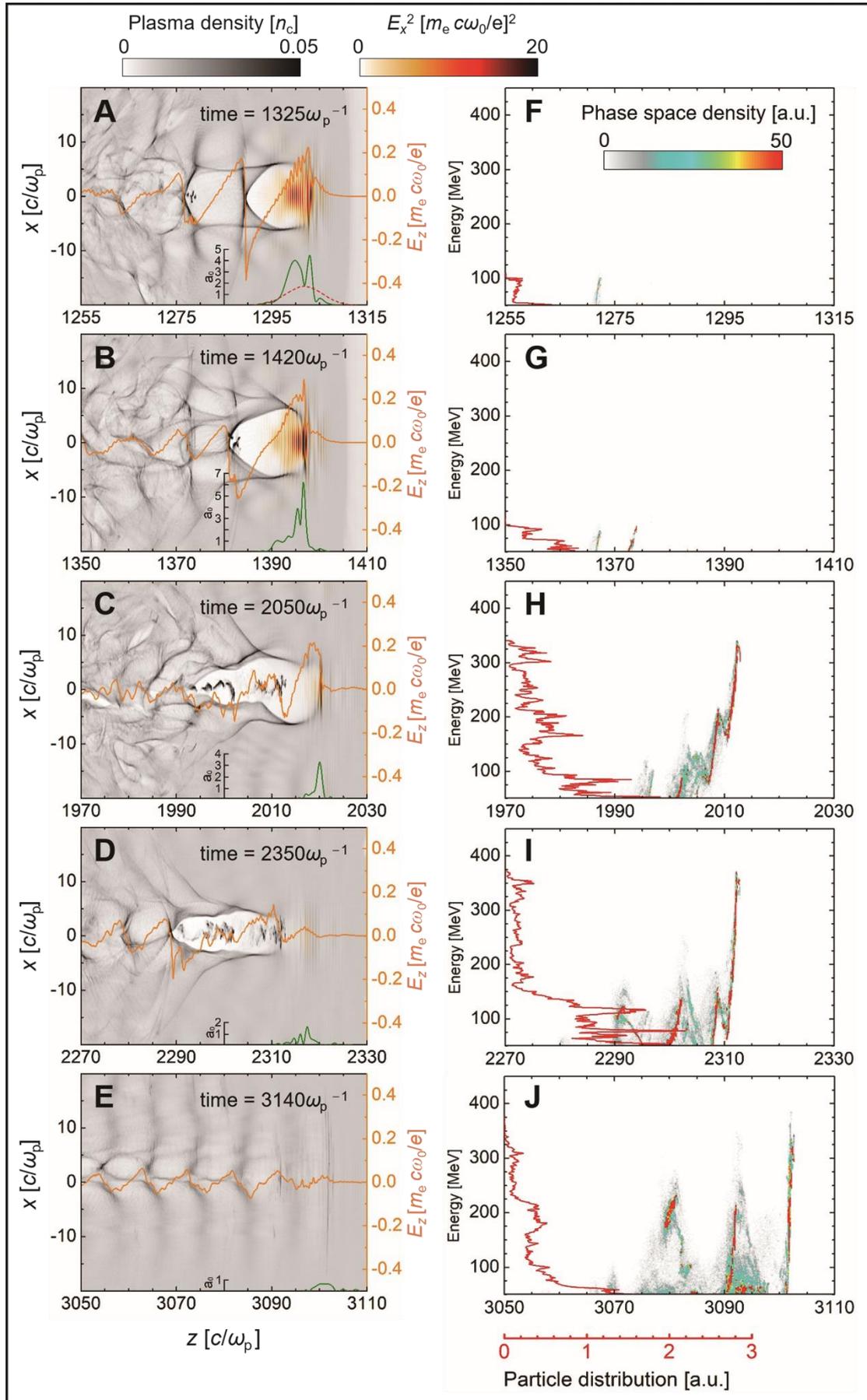


Fig. S2. 2D-PIC simulation results for an LWFA driven by full 2.1-J, 800-nm, and 30-fs laser pulse with p-polarization. (A to E) Snapshots of the laser electric field (E_x) and electron density distribution in the x - z plane at various times. (F to J) Energy-space distribution of accelerated electron with energies ≥ 50 MeV at respective times. a.u., arbitrary units. The red dashed plot in (A) is the initial laser intensity (a_0) distribution. The green and orange plots in (A to E) are the evolutions of a_0 and the on-axis longitudinal electric field (E_z) at different times. The red solid plots in (F to J) represent the electrons' energy spectra at respective times. A cutoff-energy of 375 MeV is reached at 2.3 mm, then it dropped due to pump depletion to about 320 MeV at 3.1 mm of propagation.

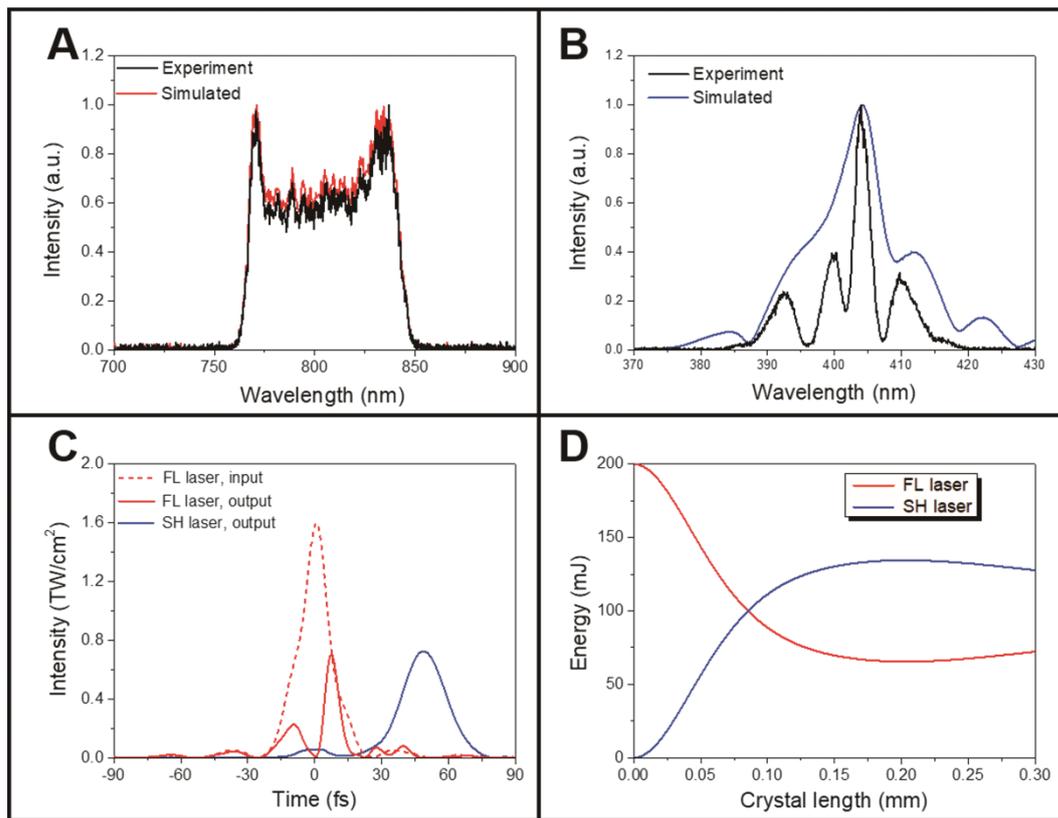


Fig. S3. Simulation of the SHG process. (A) Incident FL laser spectra measured in the experiment (black) and assumed in the simulation (red), respectively. (B) SH laser spectra as it exits from the BBO crystal in the experiment (black) and simulation (blue), respectively. (C) Temporal profile for the input (red dashed line) and output (red solid line) FL laser pulse, and the output SH laser pulse (blue solid line) in the simulation. (D) Energy conversion efficiency as a function of crystal length.

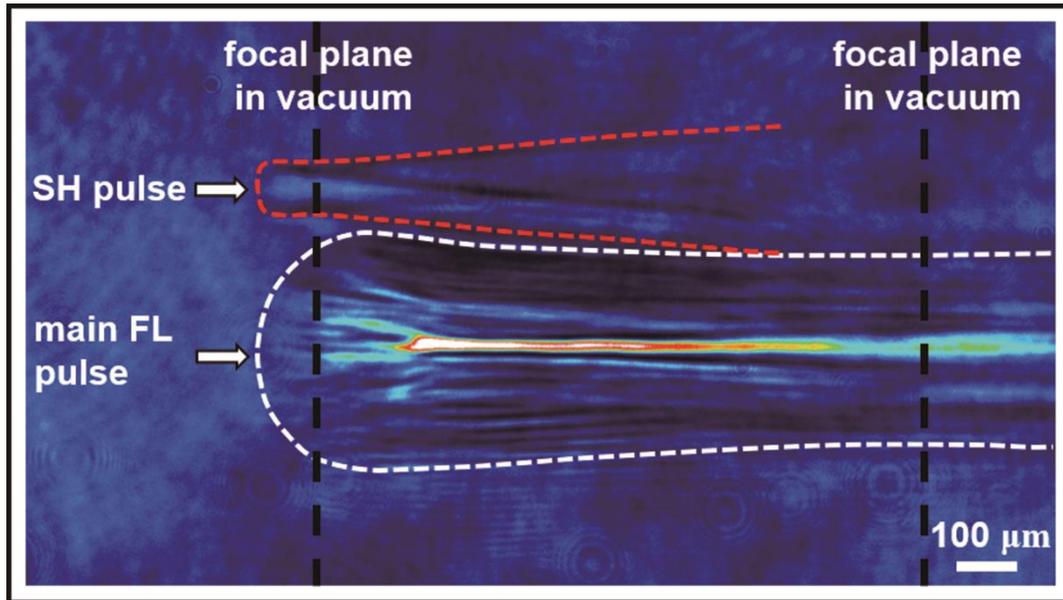


Fig. S4. Side-view plasma shadowgraph for the relative time zero ($T_0 \sim 0$ fs) between the main FL and SH pulses. A 30-fs probe laser beam (800 nm) was used as a back lighter. The white and red dash curves depict the contour of plasma channels driven by the main FL and SH pulses, respectively. Two black vertical lines show the focal planes in vacuum of main FL (right) and SH (left) pulses, respectively.