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Measurement of the decay rate of laser-driven linear wakefields

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Multi-pulse laser wakefield acceleration (MP-LWFA) is a promising scheme for increasing the repetition rate of LWFAs to to the kHz range [1-2] In this approach the laser wakefield is driven by a train of laser pulses spaced by the plasma wavelength such that the wakefields driven by each pulse interfere coherently.

A major consideration for MP-LWFA is the decay time of the wakefield, since this determines the maximum number of laser pulses that can be used. The decay time is determined by the motion of the plasma ions, which is usually neglected for short pulse drivers.

We present experimental and numerical investigations of the decay of wakefields driven in hydrogen and deuterium plasmas. The temporal decay of the amplitude of a wakefield, driven by a 44 fs laser pulse of laser parameter a0 ~ 0.5, was measured by the Temporally Encoded Spectral Shifting (TESS) method [3-4]. These results show that the amplitude of the wakefield decreases by 50% in approximately 1.3 ps, corresponding to 11 plasma periods. The experimental results are interpreted with the aid of 2D PIC simulations. A detailed design will be presented as a poster with title "Design of a laser-driven linear wakefield decay rate experiment".

Primary author: JONNERBY, Jakob (University of Oxford)

Co-authors: ARRAN, Christopher (University of York); CORNER, Laura (Cockcroft Institute, University of Liverpool); HOLLOWAY, James (The University of Oxford); HOOKER, Simon (University of Oxford); PICKSLEY, Alex (University of Oxford); ROSS, Aimee (University of Oxford); SHALLOO, Rob (Imperial College London); THORNTON, Christopher (STFC); WALCZAK, Roman (University of Oxford); Mr VON BOETTICHER, Alexander (University of Oxford)

Presenter: JONNERBY, Jakob (University of Oxford)

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