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Design of an experiment to measure 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 LWFA's 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 and related schemes 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 will present the design of the experiment presented in the talk "Measurement of the decay rate of laser-driven linear wakefields". The amplitude of a wakefield was measured up to 4 ps after excitation by a 44 fs long single laser pulse of laser parameter $a_0 \sim 0.5$. The target consisted of a gas cell backed with 20 mbar of either hydrogen or deuterium gas, and the Temporally Encoded Spectral Shifting (TESS) method [3-4] was used to measure the wakefield amplitude. The experimental layout, wakefield diagnostic, data analysis, and target design will be covered in this poster presentation.

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