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Multi-pulse laser drive to achieve higher laser-proton conversion efficiencies JAMES GREEN, CERI BRENNER, STFC, GRAEME SCOTT, STFC / University of Strathclyde, PAUL MCKENNA, University of Strathclyde, DAVID NEELY, STFC / University of Strathclyde — The broad energy spectrum that typically results from target normal sheath acceleration (TNSA) may be well suited to applications such as isochoric heating of matter and proton imaging. However, routine conversion efficiencies of a few percent must be increased to make such concepts truly feasible. A significant enhancement in the yield of laser accelerated protons has been achieved with the use of two laser pulses, narrowly separated in time (Markey et al. PRL 195008 2010). We present results and latest analysis from two experimental campaigns that have sought to increase the proton conversion efficiency further through similar multi-pulse regimes. In the first instance an optimized double-pulse interaction (pulse spacing of 1 ps) was applied in the recirculating electron regime (through the use of thin, $< 5\mu$m, targets) resulting in a conversion efficiency of $\approx 15\%$. In a following campaign a novel half-cavity target, consisting of a planar foil with a quarter-sphere attached, was employed. When using such a target the reflected laser light from the primary interaction is collected and refocused back onto the same point, creating a high intensity, double-pulse interaction. Both significant flux enhancement and low energy spectral modification were observed.

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