Contribution ID: **377** Type: **Oral contribution**

The effect of exit plasma scale-length and plasma mirrors on electron beams from a laser wakefield accelerator

Wednesday, 20 September 2023 17:05 (20 minutes)

The effect of density ramps and plasma mirrors on electron beam divergence was measured in the context of staged laser wakefield acceleration. Termination of an acceleration stage was found to increase total beam divergence from 3.38 $\pm$ 0.07 mrad to 6.13 $\pm$ 0.13 mrad, and the effect was observed to persist at high energies, up to 2.2 GeV. Additionally, shot-to-shot fluctuations in divergence dropped from 12.4$\pm$1.3% to 4.7 $\pm$ 1.2%. Using simulations and numerical models, the presence of the density ramp was shown to have a divergence-reducing effect with a magnitude that matched the experiment. The kT magnetic fields generated in plasma mirrors were investigated using simulations, and the effect of these fields on the electron beam was quantified. Compared to normal incidence, a 45 degree angle of the plasma mirror to the beam axis reduced the integrated magnetic fields inside the mirror, benefiting the electron beam emittance. The improved shot-to-shot stability was found to be due to a transition to the beam-driven regime in the density ramp. These results provide validation for the use of density ramps in future multi-stage wakefield target design.

Primary author: BACKHOUSE, Michael

Co-author: NAJMUDIN, Zulfikar (Imperial College London)

Presenter: BACKHOUSE, Michael

Session Classification: WG1:Plasma-based accelerators and ancillary components

Track Classification: WG1: Plasma-based accelerators and ancillary components