Abstract

Plasma-based accelerators are one of the emerging technologies that could revolutionize e-/e\(^+\) colliders, significantly reducing their size and cost by operating at multi-GeV/m accelerating gradients. Proof-of-principle experiments at SLAC have demonstrated the energy doubling of 42 GeV incoming e\(^-\) in a plasma only ~85 cm-long,\(^*\) corresponding to an unloaded gradient of ~50 GeV/m. Plasma wakes driven by e\(^+\) bunches are different from those driven by e\(^-\) bunches. The acceleration of e\(^+\) in plasmas has been demonstrate,\(^**\) but the acceleration of high-quality e\(^+\) beams is challenging. Measurements show that single e\(^+\) bunches suffer halo formation and emittance growth when propagating through dense meter-scale, uniform plasmas.\(^***\) Advanced schemes, such as hollow plasma channels, or e\(^+\) bunch acceleration on the wake driven by a e bunch, may have to be used in a future plasma-based linear collider. Experimental results obtained with e\(^+\) beams in plasmas will be reviewed and compared to those obtained with e\(^-\) beams. Future experiments including a new scheme to produce a drive e bunch closely followed by a witness e\(^+\) bunch appropriate for PWFA experiments will also be discussed.