

Schemes for Simultaneous Large Transformer Ratio, High Efficiency, Low Energy Spread, High Charge of Accelerated Electron Beams by Tailored Wakefield Plateaus for Long Driver and Witness Bunches

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A long driver forming a decelerating plateau in a plasma wakefield is required for maximizing the acceleration efficiency and energy gain of a witness beam. Maximizing the efficiency of the acceleration process by injecting a large witness charge, requires a tailored, long witness beam creating a beam-loaded plateau in the accelerating field. As a consequence, in the case of the highest efficiency, the transformer ratio is typically small (≈ 1). We formulate concepts for the simultaneous increase of the charge of the accelerated electron beams, the transformer ratio, and the efficiency while maintaining a low energy spread and emittance of bunches of accelerated electrons in the blowout regime.

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