

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

Thursday, 21 September 2023 17:05 (20 minutes)

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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Session Classification: WG10: ALEGRO towards colliders

Track Classification: WG10: ALEGRO towards colliders