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Large Energy Depletion of a Beam Driver in a Plasma-Wakefield Accelerator

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Beam-driven plasma-wakefield acceleration has the potential to reduce the size and construction cost of large-scale accelerator facilities, by providing accelerating fields orders of magnitude greater than that of conventional accelerating structures. To keep the running costs affordable, high energy-transfer efficiency from the wall-plug to the accelerated bunch has to be demonstrated. For this, drive bunches must be efficiently produced, strong decelerating fields must be sustained for the drive bunches until their energy is depleted, and the resulting accelerating fields must be strongly beam loaded by the trailing bunches. Here we address the second of these points, showing measurements performed at FLASHForward using a 500 MeV drive bunch where approximately half of its total energy is deposited into a 20 cm long plasma. This level of energy-transfer efficiency demonstrates that plasma accelerators hold the potential to become competitive with conventional accelerators. An experimental outlook of how to achieve this goal will conclude the talk.

Acknowledgments

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