



Contribution ID: 98

Type: **Poster with possible speed talk**

Large energy depletion of a beam driver in a plasma-wakefield accelerator

Beam-driven plasma-wakefield acceleration has the potential to reduce the building cost of accelerator facilities, with large accelerating fields that are orders of magnitude greater than those of radio-frequency cavities. Sustaining strong decelerating fields for the driver and strong accelerating fields for the trailing bunch across long plasma stages will be key to demonstrating high energy efficiency in this scheme, which is necessary to keep the running costs low for such a facility. We show first measurements at FLASHForward with a 500 MeV drive bunch depositing approximately half of its energy into a 20 cm long plasma.

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Session Classification: Conference Dinner with Poster exhibit

Track Classification: Accelerator Research and Development