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## A Plasma-Based Brightness Transformer

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High-brightness electron bunches drive fundamental research in particle physics and photon science. Key to achieving a high brightness is to have a low transverse emittance. In radiofrequency accelerators a low initial emittance can be rapidly degraded due to space-charge forces, which are greatly diminished once the electron bunch attains relativistic velocity. A plasma accelerator can maintain orders-of-magnitude higher accelerating fields than radiofrequency accelerators, while multiple techniques exist to create a low-emittance electron bunch directly inside the plasma accelerator structure. Plasma accelerators therefore offer the opportunity to take a comparatively lower-brightness electron bunch produced by a radiofrequency accelerator, and use it to drive a wakefield which traps and accelerates a significantly higher brightness electron bunch. Here we demonstrate the injection and gigavolt-per-metre acceleration of a bunch with a 3D brightness 4.8 times greater than that of the driver. The injected bunches had high reproducibility, 1 mm-mrad normalised emittance, order 10 pC/MeV spectral densities and per-cent-level energy spreads.

### Working group

WG3 : Beam-driven plasma acceleration

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