7th European Advanced Accelerator Conference

EAAC2025

Contribution ID: **482** Type: **Oral contribution**

Active energy compression of a laser-plasma accelerator

Tuesday 23 September 2025 16:20 (20 minutes)

Laser-Plasma accelerators (LPAs) promise a compact alternative to modern RF-technology. However, the central energy jitter and energy spread, both on the percent-level, have so far prevented LPAs to drive real-world applications. Here, we experimentally demonstrate active energy compression of a laser-plasma accelerated electron beam. At the LUX experiment at DESY, a dipole chicane stretches the electron bunch in time thereby imprinting an energy-time correlation (chirp), which is subsequently removed with an RF cavity. Our setup reduces the variations in central beam energy as well as the energy spread by more than an order of magnitude to the permille-level. We demonstrate performance so far only attributed to modern RF based accelerators which opens the door for a variety of applications, such as compact plasma-based injectors for synchrotron storage rings.

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Session Classification: PS5: Applications

Track Classification: PS5: Applications