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Control and propagation effects of the wavefront quality for a high-power laser system

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Laser-Plasma Wakefield Accelerators showed promising results in the past few years, generating high-energy electron beam over cm-distances. Nevertheless, the quality and shot-to-shot stability of such beams have not yet reached the level of conventional accelerators. One of the crucial factors is the driver laser beam quality, which needs to be focused close to the diffraction limit. To achieve the highest electron beam quality, the laser wavefront has to be controlled via a closed loop including a deformable mirror and a wavefront sensor. The LUX beamline, built in collaboration between ELI-Beamlines, the University of Hamburg and DESY, aims to generate and study plasma-driven undulator radiation. It is driven by the 200 TW ANGUS laser system which includes such adaptive optics. I will present results on the wavefront control of the high power laser beam, including effects of the wavefront propagation through the 35 meters long transport beamline and wavefront-based alignment of the focusing parabolic mirror. The quality of the focal spot and the propagation through the focus are investigated as the final figure of merit.

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