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Concept of an OPCPA-seeded drive laser for long-term stable plasma acceleration

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The LUX laser-plasma accelerator, built in close collaboration of the University of Hamburg and DESY, is designed to provide plasma electron beams with enhanced stability as a driver for future compact light sources. After significant in-house development of the driving 200 TW ANGUS laser system, the
laser has reached an operational stability, that enabled us to repeatedly demonstrate 24-hour operation of the laser-plasma accelerator with several 10k consecutive electron beams and high availability. However, it has become evident, that further improvements of the laser system are necessary to further enhance the quality of the generated electron beams.
We therefore are considering alternative approaches to overcome limitations in the system architecture of conventional Ti:Sapphire lasers. Here, we will present concepts, based on OPCPA technology, to provide seed laser pulses for the main amplification chain with a primary focus of long-term accelerator
operation. We derive laser stability requirements based on our experience with the LUX laser-plasma accelerator, discuss approaches for fulfilling these challenging demands, and present simulations to estimate the achievable performance.

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