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High average power laser technologies for LPA-based FELs

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In this paper, we present the state of the art laser technologies suitable for laser plasma accelerators as well as the roadmap to achieve average power scaling to the level required for future LPA-based FEL, in particular the flagship project of EuPRAXIA laser-driven machine.

We will present performance of operational performance of already operating 10 TW –100 Hz laser systems using diode-pumped lasers as pumping lasers of TiSa amplifiers. We report on development of building blocks such as active mirror TiSa disk amplifiers and active cooling of gold-coated compression gratings in order to boost performance of such lasers to 50 TW –100 Hz, available soon in laboratories, for example within EuAPPS project.

Furthermore we will report about technical strategies and the related developments which will enable to raise the performance of TiSa based CPA laser systems up to the PetaWatt peak power at 100 Hz repetition rate leading therefore to the delivery of an average power exceeding the kilowatt level. We will focus on developing the next generation of high average power compatible pulse compressors based on the use of dielectric-coated compression gratings.

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