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Optimization of a hollow-core fiber based nonlinear pulse compressor for laser wakefield acceleration experiments

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Compact laser plasma accelerators running at repetition rates >1 kHz promise a wide range of applications in science research, medicine, and security. Commercially available laser systems operating at kHz repetition rates offer mJ pulses with pulse duration as low as tens fs. To fulfill the resonant condition for the laser wakefield acceleration, temporal compression of these pulses is necessary. We report on nonlinear compression of a commercial Ti:Sapphire laser from ~40 fs to <4 fs in a hollow-core fiber compressor with 60% overall efficiency. We show that controlling the nonlinearity prior to coupling into the fiber proves to be critical to achieve high energy transmission. Through third order dispersion tuning, the peak power above 1 TW was achieved, which is suitable for driving a MeV-level laser plasma accelerator.

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Working group

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