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Thin-Disk Amplifiers and Nonlinear Pulse Compression

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Applications such as high harmonic generation, laser plasma X-ray sources, inverse Compton scattering, electron acceleration and laser-driven neutron sources demand for always higher pulse energies and peak intensities at higher repetition rates
With significant progress in high-power laser technology during the past decade, new concepts of laser driver sources are rapidly emerging for compact linear accelerators and x-ray sources. Diode-pumped ytterbium thin-disk based systems have immensely increased their performance in recent years, making them particularly appealing in conjunction with nonlinear broadening in gas-filled multipass cells. This approach overcomes the laser gain bandwidth limitation, while maintaining high optical efficiency with limited impact on the beam quality even at high average powers. Lately, we broadened the 180 mJ output of Dira 1000-5 system inside a Herriott cell to generate ~40 fs pulses at 5 kHz. Our ongoing work seeks to increase the peak power of our high-energy systems (500 mJ, 1 kHz, <600 fs) via nonlinear pulse compression and reach 400 mJ with <50 fs pulse duration. While the available driver sources of TRUMPF Scientific Lasers (1J, 1kHz, 600fs) might be already directly used to accelerate neutrons, the post compressed pulses can be implemented for laser wakefield acceleration of electrons.

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