

# Development of 20-fs 4-PW laser for laser-plasma accelerators

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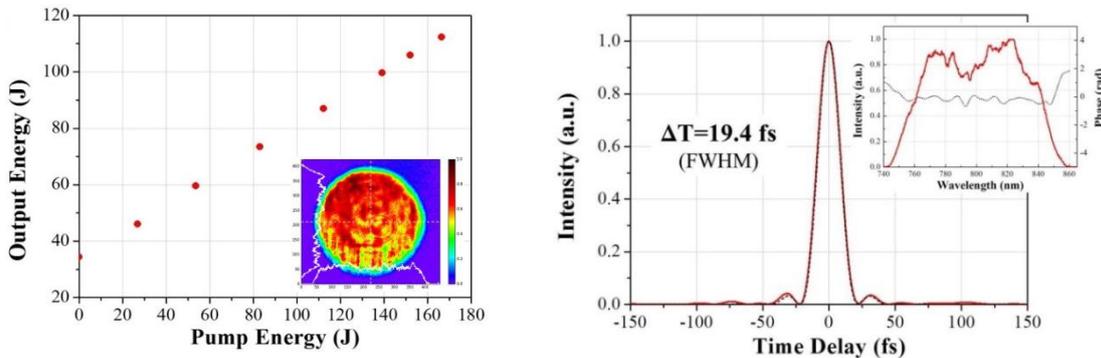
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Ultra-high intensity lasers enable to investigate the novel physical phenomena such as laser driven particle acceleration and strong field science. We have operated two ultra-intense petawatt (PW) beamlines [1, 2] and we have recently upgraded a 20 fs, 4.2 PW laser [3]. In this talk, the development of a 20 fs, 4.2 PW Ti:sapphire laser is presented.



**Figure 1.** Measured output energy as a function of pump energy in the final booster amplifier (left) and reconstructed temporal profile of the 4.2 PW laser pulse (right).

For the 4.2 PW upgrade, the existing 1.5 PW beamline has been significantly modified. We, firstly, reduced the pulse duration of the laser and then boosted the output energy. For the reduction of the pulse duration, the spectral width was broadened by adopting the XPW and the OPCPA techniques and the final spectral width was maximized by limiting the gain depletion of the next amplifiers. The output energy was boosted by adding a high energy booster amplifier. With all the modification, we achieved the final compressed laser energy of 83 J and the pulse duration of 19.4 fs, producing the 4.2-PW laser pulses at the repetition rate of 0.1 Hz with the low energy fluctuation of 1.5% rms. This 4.2 PW laser is being operated and it will be a great tool for exploring the novel physical phenomena in the unprecedented regime.

## References

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