



Applications of 100 TW class ultrashort pulse lasers

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Over the last decade laser particle acceleration of electrons and ions has made such progress that first applications in special fields can be envisioned. Prominent examples are radiation therapy with laser accelerated ion beams as well as the generation of pulsed X-ray sources. Mandatory for most applications however is, besides the obvious pulse power and thus particle energy, also a reasonable pulse repetition rate. This combination only recently became available with the development of 100 TW class Ti:Sapphire lasers.

Here we report on the demonstration of laser acceleration of proton pulses to maximum energies in the range of up to 18 MeV making use of the 100 TW table-top laser Draco recently installed at FZD [1]. Reproducible conditions allowed for the first dose controlled irradiation of cell samples, representing the first step towards radiobiological applications [2]. A detailed description of requirements and experimental procedures will be given.

On the other hand, laser accelerated electrons as well as conventionally accelerated electrons can be used for driving light sources, in our case based on Thomson scattering. We give a status report on the combined electron accelerator / 100 TW laser facility at FZD and present detailed simulations of such sources, including a tilted pulse front geometry that can significantly enhance the photon yield [3].

[1] K. Zeil, et al., *Scaling of proton energies in ultrashort pulse laser plasma acceleration*, New Journal of Physics 12, 045015 (2010)

[2] S.D. Kraft, et al., *Dose dependent biological damage of tumour cells by laser-accelerated proton beams*, New Journal of Physics 12, in press (2010)

[3] A. Debus, et al., *Traveling-wave Thomson scattering and optical undulators for high-yield EUV and X-ray sources*, Applied Physics B, in press (2010)