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Deuteron acceleration and fast neutron generation with a 10Hz few-cycle laser

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Many applications require a (quasi) continuous source of ions and neutrons operating in a 24/7 mode. Recent developments of few-cycle laser systems with an average optical power of 100 W have laid the technological basis for the development of such a particle source.
In the experimental series in ELI-ALPS, Hungary, first we have demonstrated that ions can be efficiently accelerated above 1MeV with laser pulses of 20 mJ energy and 12 fs pulse duration. The accelerated deuterons generate fast neutrons via DD fusion reaction in a deuterated PE tablet. The deuterons have been measured shot-by-shot with Thomson ion spectrometers. Neutrons were characterized by time-of-flight scintillators as well as bubble detectors. Following the development of an ultrathin liquid sheet target system, it became possible to operate the laser deuteron accelerator continuously for more than six hours at 10 Hz repetition rate. As a next step, the neutron flux will reach 10^8 neutron / sec with the use of a kHz laser system.

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