Laser-target experiments at PALS

J. Krása[1], D. Klír[2,3], K. Řezáč[2,3], J. Cikhardt[2,3], M. Pfeifer[1,3], J. Dostál[1,3], M. Krůs[3],
T. Burian[1,3], R. Dudžák[1,3], T. Pisarczyk[4], Z. Kalinowska[4], T. Chodukowski[4]
[1] *Institute of Physics of Czech Academy of Sciences, Prague, Czechia*
[2] *Faculty of Electrical Engineering, Czech Technical University in Prague, Prague, Czechia*
[3] *Institute of Plasma Physics of Czech Academy of Sciences, Prague, Czechia*
[4] *Institute of Plasma Physics and Laser Microfusion, Warsaw, Poland*
krasa@fzu.cz

The PALS laser facility is the iodine high-power laser system which is capable of delivering up to 1 kJ of energy at the fundamental wavelength 1.315 μm on a target. At pulse duration of about 350 ps, the laser produces power of 3 TW. The minimum diameter of the focal spot of ~70 μm provides a maximum value $I\lambda^2 \approx 5\times10^{16}$ Wcm^{-2}μm^2. By the use of various experimental techniques it will be shown that the relativistic electrons, MeV protons and deuterons can be generated as well as neutrons through e.g. ^{2}H(d,n)^{3}He and ^{7}Li(d,n) fusion reactions can be produced [1-3]. The observed values of maximum proton energies and electron temperatures indicate that the laser intensity should reach a relativistic level through the laser beam self-focusing. The occurrence of electron bunches in front of irradiated target surface has been identified by the time resolved femtosecond interferometry. The number of electrons being able to escape the plasma through the plasma potential barrier is estimated via kiloampere target current neutralizing the positive charge generated on the target, which is equal to the charge taken away from the plasma by these fast electrons [4]. Basic characteristics of transient electromagnetic pulses driven by the target current will be presented [5].

References

[1] J. Krása, et al., Laser Part. Beams 31, 395 (2013).
[2] D. Klír et al., Phys. Plasmas 22, 093117 (2015).
[3] J. Krása et al., Phys. Plasmas 25, 113112 (2018).
[4] J. Cikhardt et al., Rev. Sci. Instrum. 85, 103507 (2014).
[5] J. Krása et al., Plasma Phys. Control. Fusion 59, 065007 (2017).