DEVELOPMENT OF Z-PINCH LASER DIAGNOSTICS AT THE ZEBRA GENERATOR*

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The 50 TW Leopard laser coupled with the 1-MA Zebra generator was used for the development of new diagnostics for z-pinch plasmas. Two plasma diagnostics are presented: an x-ray broadband backlighting for z-pinch absorption spectroscopy and parametric two-plasmon decay of the laser beam in dense z-pinch plasma. The implementation of the new diagnostics on the Zebra generator and the first results are discussed. The absorption spectroscopy is based on backlighting the z-pinch plasma with broadband x-ray radiation from the Sm laser plasma. The absorption spectroscopy can deliver data about the electron temperature and density of z-pinch plasma at the non-radiative stage. The parametric two-plasmon decay of intensive laser radiation generates 3/2ω and 1/2ω harmonics. These harmonics can be used to derive the temperature of the z-pinch plasma with the electron density near the quarter of critical plasma density [1]. Ultraviolet (UV) laser probing diagnostics at the wavelength of 266 nm have been developed for the investigation of the 1-MA Z-pinch plasma. The smaller absorption and refraction in dense plasma at the wavelength of 266 nm allows for a deeper penetration into the dense Z-pinch plasma. These features allow for the observation of fine details in the Z-pinch plasma at the implosion and stagnation phases. A shadowgraphy channel with a spatial resolution of 4 μm was tested. An electron density $N_e > 5 \cdot 10^{19}$ cm^{-3} was measured directly in the stagnated Z-pinch with interferometry at 266 nm. Further development of laser probing diagnostics includes a UV Faraday rotation diagnostic and two-frame UV shadowgraphy. UV laser probing diagnostics give the opportunity to investigate the micro structures and current distribution in the stagnated Z-pinch.

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