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X-ray diagnostics of laser-induced plasma embedded in strong magnetic field with misaligned orientation

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The present work is aimed at the experimental study of the dynamics of laser-induced plasma immersed in a strong poloidal magnetic field with variable orientation (0◦–90◦ depending on the plasma expansion) and amplitude (up to 30 T). The significance of such studies is especially important for the tasks of laboratory astrophysics and inertial confinement fusion. In the experiment, the plasma jet is initiated by the interaction of 20-40 J laser pulses of 0.6 ns duration with a bulk CF_2 targets and then diagnosed by x-ray spectroscopy and optical interferometry. Electron density and temperature profiles are measured, effects related with plasma collimation and accumulation in the external magnetic field are discussed. External transverse magnetic field (90 degrees) forms a shocked plasma region with increased values of electron temperature and density regarding the cases of a free propagation and a propagation in the longitudinal magnetic field. The localization of this region depends on a magnetic field strength. The effect of the plasma separation is observed where two plasma fractions with velocities ~10^8 and 4x10^7 cm/s were concerned. The development of Rayleigh-Taylor instabilities due to a transverse magnetic field is shown.

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