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Local measurements of magnetic reconnection driven by electron dynamics in GEKKO XII laser facility

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Magnetic reconnection converts the magnetic energy to the kinetic and thermal energies of plasma by changing the topology of magnetic field. The microscopic electron dynamics triggers magnetic reconnections [1], however, there are no experimental evidences on the electron-scale motion in laser-driven reconnection experiments. Controlling the strength of the externally applied magnetic field, we have been conducting experiments on the electron dynamics in magnetic reconnection [2]. Here we report local velocity and magnetic field measurements using collective Thomson scattering and magnetic induction probe [3]. The local velocity measurements in Fig. 1 show the electron Alfvénic outflow that is not accompanied with the ion outflow. The local magnetic field measurements show the magnetic field inversion corresponding to the plasmoid and the whistler waves associated with the electron dynamics. Our results indicate that the electron dynamics triggers the magnetic reconnection in the scale less than the ion gyration.

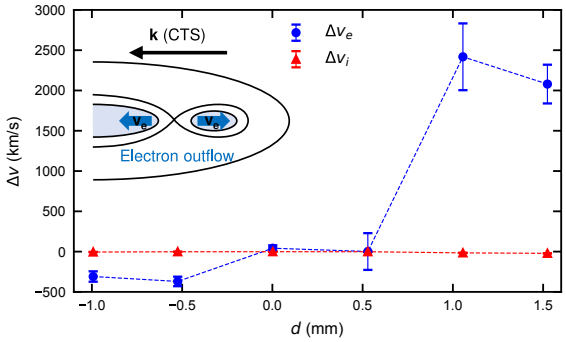

Fig. 1: Velocity difference with and without the external magnetic field [3].

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