Dependence of core heating properties on heating pulse duration and intensity in FIREX project

T. Johzaki, H. Sakagami[a], H. Nagatomo, A. Sunahara[b], H. Cai, K. Mima

Institute of Laser Engineering, Osaka University, 2-6 Yamadaoka, Suita 565-0871, Japan
[a] National Institute for Fusion Science,322-6 Oroshi-cho, Toki 509-5292, Japan
[b] Institute for laser Technology, , 2-6 Yamadaoka, Suita 565-0871, Japan

e-mail: tjohzaki@ile.osaka-u.ac.jp

In the cone-guiding fast ignition, an imploded core is heated by the energy transport of fast electrons generated by the ultra-intense short-pulse laser at the cone inner surface. The fast core heating (~800eV) has been demonstrated at integrated experiments with GEKKO-XII+PW laser systems [1]. As the next step, experiments using more powerful heating laser, FIREX (Fast Ignition Realization Experiments)[2], have been started at ILE, Osaka university. In FIREX-I (phase-I of FIREX), our goal is the demonstration of efficient core heating (T_i ~ 5keV) using a newly developed 10kJ LFEX laser.

In the first integrated experiments, the LFEX laser is operated with low energy mode (~0.5kJ/1~4ps) to validate the previous GEKKO+PW experiments. Between the two experiments, though the laser energy is similar (~0.5kJ), the duration is different; ~0.5ps in the PW laser and 1~ 4ps in the LFEX laser, which means the difference in the laser intensity and then the fast electron generation. In this paper, we evaluate the dependence of core heating properties on the heating pulse duration, together with the pre-plasma effects, on the basis of integrated simulations with FI^3 (Fast Ignition Integrated Interconnecting) code system [3].

[1] R. Kodama, et al., Nature **418** (2002) 933.
[2] H. Azechi and the FIREX Project, Plasma Phys. Control. Fusion **48** (2006) B267.
[3] H. Sakagami and K. Mima, Laser Part. Beams **22** (2004) 41; H. Sakagami, et al., Laser Part. Beams **24** (2006) 191; T. Johzaki, et al., Laser Part. Beams **25** (2007) 621; H. Sakagami, et al., Nucl. Fusion **49** (2009) 075026; H. Nagatomo, et al., Nucl. Fusion **49** (2009) 075028.