Contribution ID: **157** Type: **Poster**

Improvement in the heating efficiency of Fast Ignition inertial confinement fusion by suppressing the preformed plasma

Thursday, 20 October 2016 08:30 (4 hours)

In the fast ignition scheme, a fusion fuel is compressed by implosion laser and then heating laser heats the core plasma to ignition temperature. The heating laser interacts with the cone target and fast electrons are accelerated, and the electrons are absorbed by the core plasma so that the core plasma is heated to ignition temperature. Since LFEX (heating laser) energy is limited to 10 kJ at maximum, the energy coupling efficiency from laser to the core plasma must be larger than 10 %. In previous studies the energy coupling efficiency was limited up to 0.37 % which was determined by the electron spectrum and the fuel core plasma density profile. The main reason of the low coupling efficiency was the electron spectrum was consisted with too much high energy.

The electron spectrum is strongly dependent on the scale length of the preplasma on laser interaction region, thus the suppression of the preplasma is key issue. We have two problems of preplasma creation, one is the prepulses of the LFEX laser, and second the preformed plasma originated by cone-target breaking by the implosion. In this paper especially the latter is discussed. If the cone target is not enough tough, it will be destroyed by implosion pressure before heating laser injection, then the heating laser interacts with the preformed plasma, and in this way too much high energy electrons are generated. LFEX pulse contrast was improved up to 10^9 in 2015 from ~10^8 in 2013. In this study we directly observed the time when the cone target is broken by observing a reflected probe laser from cone tip by using an optical streak camera (VISAR diagnostics).he previous 7-micron thick cone was broken before the maximum core-compression time. We modified it to 14-μm thickness (wall and tip are both 14-micron) so that cone-breaking time was delayed after the implosion laser peak. Electron spectrums were measured under the improved condition. The colder electron spectrum was obtained in the condition. After the improvement the energy coupling efficiency from laser to the core plasma was resulted to be 2 % with 5 times increment from 2013's experiment.

Paper Number

IFE/P5-11

Country or International Organization

Japan

Primary author: Dr ARIKAWA, Yasunobu (Insituteof Laser Engineering Osaka University)

Co-authors: Dr YOGO, Akifumi (Institute of Laser Engineering, Osaka university); Dr MORACE, Alessio (Institute of Laser Engineering, Osaka university); Dr SUNAHARA, Atsushi (Institute for Laser Technology); Dr NAGATOMO, Hideo (Institute of Laser Engineering, Osaka university); Prof. NISHIMURA, Hiroaki (Institute of Laser Engineering, Osaka university); Prof. AZECHI, Hiroshi (Institute of Laser Engineering, Osaka University); Prof.

SHIRAGA, Hiroyuki (Institute of Laser Engineering, Osaka University); Dr SAKAGAMI, Hitoshi (National Institue for Fusion Science); Dr KAWANAKA, Junji (Institute of Laser Engineering, Osaka university); MATSUO, Kazuki (Institute of Laser Engineering, Osaka university); Dr SHIGEMORI, Keisuke (Institute of Laser Engineering, Osaka university); Mr LAW, King Fai Farley (Institute of Laser Engineering, Osaka university); Dr YAMANOI, Kohei (Institute of Laser Engineering, Osaka university); Mr SEUNGHO, Lee (Institute of Laser Engineering, Osaka university); Dr HATA, Masayasu (Institute of Laser Engineering, Osaka university); Prof. NAKAI, Mitsuo (Institute of Laser Engineering, Osaka university); Prof. MIYANAGA, Noriaki (Institute of Laser Engineering, Osaka university); Mr KOJIMA, Sadaoki (Institute of Laser Engineering, Osaka University); Dr TOKITA, Shigeki (Institute of Laser Engineering, Osaka university); Prof. FUJIOKA, Shinsuke (Institute of Laser Engineering, Osaka university); Mr SAKATA, Shohei (Institute of Laser Engineering, Osaka university); Mr TOSAKI, Shota (Institute of Laser Engineering, Osaka university); Mr MATSUBARA, Shuto (Institute of Laser Engineering, Osaka university); Dr JOHZAKI, TOMOYUKI (Graduate School of Engineering, Hiroshima University); Dr JITSUNO, Takahisa (Institute of Laser Engineering, Osaka university); Prof. NORIMATSU, Takayoshi (Institute of Laser Engineering, Osaka university); Mr KAWASHIMA, Taketsugu (Institute of Laser Engineering, Osaka university); Mr OZAKI, Tetsuo (National Institute for Fusion Science); Dr XAVIER, Vaissearu (Institute of Laser Engineering, Osaka university); Dr FUJIMOTO, Yasushi (Institute of Laser Engineering, Osaka university); Dr HIRONAKA, Yoichi (Institute of Laser Engineering, Osaka university); Dr NAKATA, Yoshiki (Institute of Laser Engineering, Osaka university); Mr ABE, Yuki (Institute of Laser Engineering, Osaka university); Mr KATO, Yusuke (Institute of Laser Engineering, Osaka university)

Presenter: Dr ARIKAWA, Yasunobu (Insituteof Laser Engineering Osaka University)

Session Classification: Poster 5

Track Classification: IFE - Inertial Fusion Experiments and Theory