28E21P

高速点火の最適化のための各種ターゲットにおける電子スペクトルの比較
Comparison of Electron Spectra in targets for FIREX

尾﨑　哲[1]、白神宏之[2]、藤岡慎介[2]、坂上仁志[1]、有川安信[2]、波元拓也[2]、Z.Zhang[2]、砂原淳[2]、坂和洋一[2]、長井圭治[2]、小島完興[2]、長友英夫[2]、城崎知至[3]、FIREX実験グループ[2]
TETSUO OZAKI[1], HIROYUKI SHIRAGA[2], SHINSUKE FUJIOKA[2], HITOSHI SAKAGAMI[1], YASUNOBU ARIKAWA[2], et al.
[1]核融合研、[2]阪大レーザー、[3]広大工学院
[1]NIFS, [2]ILE Osaka Univ., [3]Hiroshima Univ.

The traditional fast ignition has been performed as follows; (1) an imploded core is produced by a compression of a shell with a guiding cone using the imploding laser, (2) the hot electron which is produced by the auxiliary heating laser, irradiates the core, and (3) the core reaches the ignition temperature and the burning occurs. The hot electron is generated by the interaction of the pre-plasma, formed by the pre-pulse before the main pulse of the heating laser at the tip of the guiding cone. To achieve higher coupling efficiency between the core and the hot electron, the effective hot electron temperature (T_{eff}) should keep less than 2MeV. Generally, T_{eff} becomes high when the pre-plasma scale length is long. In this case, the low energy component, which is suitable for core heating, decreases. Therefore the low T_{eff} with the high electron conversion efficiency is required for fast ignition. Here the electron spectrum and T_{eff} are measured by the electron spectrometer (ESM). It is difficult to measure the low energy component of the hot electron using ESM because there is a strong potential around the target. ESM can observe the higher energy spectrum of the hot electron.

In previous experiment series FG02, T_{eff} increased when LFEX laser was injected at the maximum compression time. It was doubted that the pre-plasma with the long scale length was created by irradiation of the residual ω light from the imploding laser (Gekko XII) to the inner wall of the cone. In the last experimental series FI01, T_{eff} can decrease by elimination of ω light. In FG02, Au-cone was used as the guiding cone. However many hot electrons have been dissipated in the Au-cone instead of the core. Huge X-rays and γn-neutron as background noise, had disturbed the diagnostics. Suitable cone material is selected by the target competition. In this competition, Ta of 1 mm-thick is set behind of the cone-shell target. The low energy electron flux measured by Kα emission from Ta was compared in several different cones (Au-, double-, hole- and DLC- (diamond like carbon) cones). From those, we choose DLC instead of the Au-cone. In the integrated experiments, we confirm that the electron flux in DLC-cone is similar to Au-cone. The Au-coated DLC-cone is used because T_{eff} in DLC-cone is slightly higher than T_{eff} in Au-coated DLC-cone. An external magnetic field induced by the laser (B_{ext}), is applied in order to guide the diverged hot electron to the core. The hot electron converging can be observed by application of B_{ext}. At this time, the neutron can also increase. The hole-cone as the advance target has been tried. We worried about the pre-plasma with long scale length, which comes from ablation because it may make higher T_{eff}. However T_{eff} is not so high because the pre-plasma is produced in the shell. The neutron can also increase in the integration experiment using the hole-cone.

All T_{eff} in FI01 are plotted as function of the LFEX laser intensity in Fig. 1. Lines mean the scaling by Pukov at different scale lengths. Open, half open and closed symbols show T_{eff} of plates, cones and integrate, respectively. T_{eff} of cones are similar to T_{eff} of integrate although T_{eff} of cones are higher than T_{eff} of plates. This means that T_{eff} is determined by the geometrical shape of the pre-plasma.

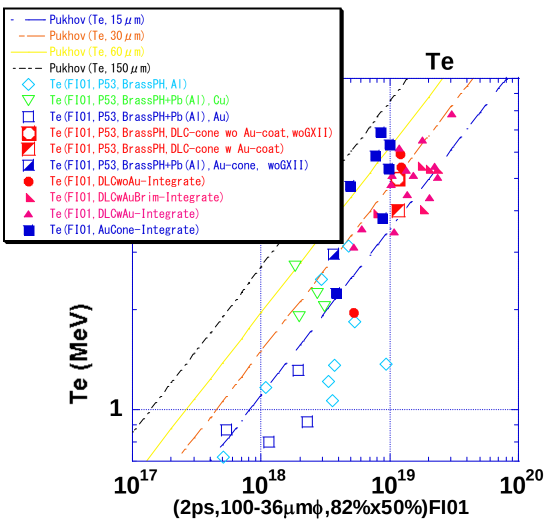

Fig. 1 T_{eff} of plates, cones and integrate.