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PRESENT STATUS AND PROSPECTS OF FIREX PROJECT

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Abstract. The goal of the first phase of Fast Ignition Realization EXperiment (FIREX) project (FIREX-I) is to demonstrate ignition temperature of 5-10 keV, followed by the second phase to demonstrate ignition and burn. Since starting FIREX-I project, plasma physics study in ILE has been devoted to increase the coupling efficiency and to improve compression performance.

The heating efficiency can be increased by the following two ways. 1) A previous experiments indicate that the coupling of heating laser to imploded plasmas increases with coating a low-density. foam used in the experiment, low-Z plastic foam is desired for efficient electron transport. (Lei et al. 2006). 2) Electrons generated in the inner surface of the double cone will return by sheathe potential generated between two cones. A 2-D PIC simulation indicates that hot electron confinement is improved by a factor of 1.7 (Nakamura et al. 2007). Further optimization of cone geometry by 2-D simulation will be presented in the workshop.

The implosion performance can be improved by three ways. 1) Low-Z plastic layer coating on the outer surface of the cone: The 2D hydro-simulation PINOCO predicts that the target areal density increases by a factor of 2. 2) Br doped plastic layer on a fuel pellet may significantly moderate the Rayleigh-Taylor instability (Fujioka et al. 2004), making implosion more stable. 3) Reducing vapor gas pressure in a pellet is necessary to suppress strength of a jet that will destroy the cone tip. (Stephens et al. 2005).

As for the cryogenic target fabrication, R&D of fabricating foam cryogenic cine shell target are under development by the joint group between Osaka Univ. and NIFS.

The amplifier system of the heating laser LFEX is completed in March 2008. The amplification test has demonstrated laser energy of 3 kJ/beam at 3nm bandwidth. The equivalent 12 kJ in 4 beams meets the specification of LFEX. The large tiled gratings for pulse compressor are completed and installed. The short pulse laser will be delivered on a target in September, 2008. The fully integrated fast ignition experiments is scheduled on February 2009 until the end of 2010. If subsequent FIREX-II will start as proposed, the ignition and burn will be demonstrated in parallel to that at NIF and LMJ, providing a scientific database of both central and fast ignition.

References

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