Experiments On Shock Ignition : What Has Been Done

Sophie D. Baton
LULI, CNRS-Ecole Polytechnique-CEA-ParisVI, 91128 Palaiseau, France

Shock ignition, a new approach to inertial confinement fusion (ICF) [1], is being studied as an alternative option for achieving high target gains for inertial fusion. In this scheme, fuel compression and ignition are separated. The idea is to compress the target at low velocity and low isentropic fuel assembly and then to trigger a final ''spark'' to ignite the compressed fuel by a strong convergent shock launched with a high intensity spike. Because the implosion velocity is significantly less than the one required for hot spot ignition, considerably more fuel mass can be assembled for the same shell kinetic energy, shock ignition has the potential for high gains at low drive energy. The attractiveness of shock ignition scheme relies first of all on a relatively simple and robust implosion scheme and on the ignition shock that can be realized on the existing laser facilities: this scheme does not require high power unconventional lasers nor any complex cone-in-shell target.
Nevertheless, experiments are necessary to study laser plasma interaction in the spike conditions, which is strongly non linear, and the capacity to launch high shock pressure up to 300 Mbar.
In this presentation, experimental results obtained up to now from different laser facilities in planar (LULI, PALS and OMEGA) and spherical (OMEGA) geometries will be reported by showing the pressure reached and the different aspects of interaction (level of laser plasma instabilities and hot electrons).
A recent experiment performed on the LIL facility (France) using two kinds of targets (planar and spherical) showed an effect linked to the sphericity that increases the shock velocity.

[1] R. Betti, C.D. Zhou, K.S. Anderson, L.J. Perkins, W. Theobald, and A.A. Solodov, Phys. Rev. Lett. 98, 155001 (2007).