1. REPORTS

Study of laser coupling in Shock Ignition related regime
PI : Petra Koester (INO Pisa) and Jan Badziak (IPPLM Warsaw)

Experiment at PALS : 22/8/2011 to 14/10/2011

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The aim of the proposed experiment is to study the effect of large scale preformed plasma on parameters of laser-driven shock wave produced in a planar target at the physical conditions relevant to Shock Ignition. The investigations are to be focused on the determination of global characteristics of the shock (total energy, velocity) at the final stage of its propagation through the target as a function of the preformed plasma characteristics (controlled by the laser prepulse) and the main laser pulse intensity.
The experiments will require 2 laser pulses and several diagnostics as :

- one interferometer coupled with a probe beam, to characterize the density profil of the plasma
- Ions collectors and thomson parabola to characterize the ion distribution velocity
- backscaterring light calorimeter to estimate the fraction of the lost laser energy induced by parametric instabilities
- Soft X rays and visibile detectors to measure the shock velocity
- used of massive target to produce a crater and to then to determine the shock energy.

The aim of my application is to participate to the experiments from target, lasers beams alignments and to record the data on plasma diagnostics and their treatment and interpretation. I have a good experience on large scale laser plasma experiments (18 years) as interferometry, ion collectors, electron spectrometer etc (see CV and list of publication). Nevertheless, these diagnostics have already been developped and managed by the collaborations teams.
Futhermore, I will be in fast contact with the theoritical group of CELIA to help us, during the experiment time, on the interpretation on the data and then to help us on the choice on several parameters for the following laser shots.
It will be a new opportunity to start a new collaboration between teams from PALS, Warsaw, Italy and Bordeaux. This will be a chance for all of them to exchange ideas, expertises in lasers plasmas experiments using large laser facilities. The plan of the experiment should or could be discussed by the collaborators or the PIs (or maybe I hope so, already done !). I am an University Professor, and as Dimitri Batani, we have to teach half-time at Bordeaux University. So it is not easy to avoid 8 weeks during the autumn period ! We have tried with our collaborators to plan our visit to PALS continuously to optimize our works.
To summarize my rôle during 2 weeks will be : to support the CELIA teams experimental part, to have a direct correspondance with the CELIA teams theoritical part, to developp a new collaboration in the topics of Shock Ignition.

CONTRIBUTION

Since there is some modification on the plan of the experiment, I went one week in PALS, instead of two weeks.

During this week, my contribution was mainly to determine the focal spot by a different way that had been done by the PALS staff. First, we used an imaging system with a lens and a camera to

image the focal spot in transmission direction. Then, we have shown that we needed to make this measurement in vacuum because the laser intensity was sufficient to ionize the air, so the image obtained in air was not significant of the focal spot (plasma defocusing etc …).
We have shown that the position of the focal spot in vacuum is one millimiter away from the position given by the method used in the past. We measured the focal spot which contains large geometrical aberration (used of a strong aperture). The focal spot contains 3 intense spot of 20 microns diameter, inside a 100 microns diameter lower intense spot, with a caracteristic shape of the coma (the other method, by measured the crater in solid target, gave a spot size larger than 100 microns).
From the measurement of the shock velocity, the pressure at the front side has been determined and compared with numerical simulations by assuming some simplifying parameters on the focal spot (which intensity has to be consider in such experiment, without using 3D calculation !)