# Strong Shock generation by laser plasma interaction in presence or not of laser smoothing (SSD) in the context of shock ignition studies on LMJ-PETAL facility

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Shock Ignition approach to ICF relies on the generation of a strong spherical shock at the end of the compression phase using a laser spike of intensity larger than a few $10^{15}$ W/cm². At this intensity, a large amount of hot electrons are likely to be created through parametric instabilities (stimulated Raman scattering, two plasmon decay). Depending on their number and average energy, they preheat the target or enhance the ignition shock pressure [1]. These processes need to be carefully studied in order to evaluate the shock pressure that would be achievable on the LMJ. Our experiment on the LMJ-PETAL facility has been accepted and will be conducted during the years 2018-2019. It aims to investigate the laser-target coupling in realistic ICF conditions, the characteristics of hot electrons energy and flux, and the effect of the laser beam smoothing on the hot electrons production and shock strength.

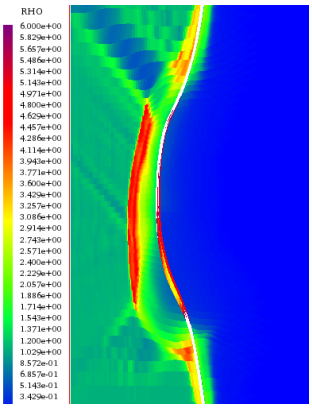


Figure 1 : Density map from a CHIC simulation of a CH target irradiated by three LMJ quads (t=6.2 ns)

We present the results of 2D radiation-hydrodynamic CHIC [2] simulations with a recently added module for the treatment of hot electrons production and transport [3]. The simulated target consists of a CH cylinder with three embed K-alpha layers (Cu, Ag and Mo) irradiated by three LMJ quads at 41°,-41° and 57° from the target normal. The laser pulse is tailored in order to create a plasma corona with parameters relevant to Shock Ignition and a spike with an intensity of $\sim 10^{16}$ W/cm².

The simulations show that the hot electron energy deposition leads to a non-spherical shock due to the incidence angle of the LMJ quads (figure 1). A post processing tool has been developed in order to simulate the expected radiography along the polar axis (picosecond radiography using PETAL beam) and along the equatorial axis (nanosecond radiography using a LMJ quad and a framing camera), with realistic spatial resolutions. In parallel, the hot electron source from CHIC simulations have been used as input for Geant4 simulations in order to simulate the response the hard X-ray spectrometer SPECTIX (measurement of the hot electron average energy) and a potential Bremsstrahlung spectrometer based on IP stack.

## References

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