Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Numerical simulations of laser hole boring for fast ignition fusion[1]

R. TRINES, P. NORREYS, STFC Rutherford Appleton Laboratory, Didcot, UK, G. SARRI, M. BORGHESI, Queens University, Belfast, UK — Hole boring fast ignition is an attractive scenario for fast ignition (FI) fusion, as it requires much simpler targets than cone guided FI, a clear advantage for future operations at high repetition rate. In a recent experiment at the Rutherford Appleton Laboratory, hole boring has been investigated in a laser parameter regime (25 ps, 10^{18} W/cm^2) that is relevant to realistic FI scenarios but has scarcely been investigated before. We have conducted particle-in-cell simulations of laser-driven hole boring in plasma that follow the conditions of this experiment, i.e. at the critical density and at 1% of the critical density. At the lower density most of the laser energy is transmitted through the plasma, while at the higher density most of the energy is absorbed, leading to large differences in the evolution of the laser-driven channel. Good agreement between the numerical and experimental results has been obtained. Possible physical mechanisms underlying the hole boring process and the consequences of our findings for hole boring FI will be discussed.

[1]We gratefully acknowledge the Osiris consortium for the use of Osiris 2.2. This work is supported by the STFC Accelerator Science and Technology Centre.

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Date submitted: 17 Jul 2009 Electronic form version 1.4