PROTON RADIOGRAPHY AND FAST ELECTRON PROPAGATION THROUGH CYLINDRICALLY COMPRESSED TARGETS

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The paper describes the key points contained in the short term HiPER experimental road map, as well as the results of two phases of the experiment performed in "HiPER dedicated time slots. Experimental and theoretical results of relativistic electron transport in cylindrically compressed matter are presented. This experiment was achieved on the VULCAN laser facility (UK) using four long puls beams (~4 × 50 J, 1 ns, at 0.53μm) to compress a hollow plastic cylinder filled with plastic foam of three different densities (0.1, 0.3 and 1 g cm−3). In the first phase of experiment, protons accelerated by a picosecond laser puls have been used to radiograph the cylinder filled with 0.1 g/cc foam. Point projection proton backlighting was used to measure the degree of compression as well as the stagnation time. Results were compared to those from hard X-ray radiography. Finally, Monte Carlo simulations of proton propagation in the cold and in the compressed targets allowed a detailed comparison with 2D numerical hydro simulations. 2D simulations predict a density of 2–5 g cm^{-3} and a plasma temperature up to 100eV at maximum compression. In the second phase of the experiment a short pulse (10ps, 160 J) beam generated fast electrons that propagate through the compressed matter by irradiating a nickel foil at an intensity of 5×10^{18} Wcm^{-2}. X-ray spectrometer and imagers were implemented in order to estimate the compressed plasma conditions and to infer the hot electron characteristics. Results are discussed and compared with simulations.