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High Resolution Radiography Researches Based on Picosecond Laser

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High spatial resolution X-ray radiography has widely applications in inertial confinement fusion (ICF) and high energy density physics (HEDP) experiments. Generally, the X-ray sources used in ICF and HEDP experiments are produced by high energy nanoseconds laser heating a planner target, hence, a high resolution radiography must been with the aid of imaging optic-elements and fast detectors for higner temperal resolution. Unlike long-pulse laser drive X-ray sources with large size and nanosecond orders pulse duration, the short-pulse laser drive X-ray sources with short pulse and higher X-ray energy, thus higher penetrating power, but no imaging elements, its imaging diagnostics generally work in point projection mode. Time-resolved radiographic images of the ICF targets were obtained with hard X-rays generated by irradiating a short-pulse laser on a metal microwire. In order to increasing the efficiency of laser conversation to x-ray, we investigated a novel technique of coded-source radiography based on wire-array and annular targets, and proved that this technique has an increased spatial resolution and contrast than that using the Gaussian source produced by single-wire targets. In this talking, the x-ray source characters and imaging diagnostic researches based on picosecond laser will be reviewed.

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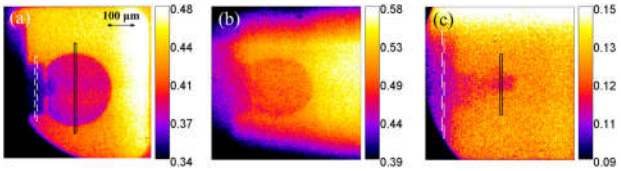

FIG. 1. Time-resolved radiographic images of indirectly driven double shell targets. (a) Shot 105, only short-pulse laser, un-driven target. (b) Shot 104, t = 2.76 ns. (c) Shot 108, t = 4.45 ns.

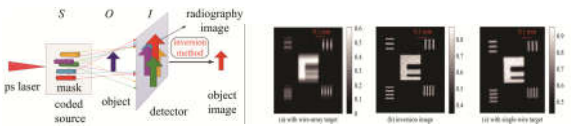

FIG.2. Diagram of laser driven X-raysource coding radiography and the experimetal image with wire-array target, inversion image and radiography image with single-wire target