**The Development of a Pulse Dilated Wolter-like X-ray microscope for the Imaging of the Hot Spot in a High-modes Asymmetry**

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**Abstract:** In the laser driven inertial confinement fusion, the fuel filled capsule will converge rapidly in a high implosion velocity. The slight driven asymmetry or the small defects in the shell may form the seeds of the Rayleigh-Taylor (R-T) instability growth. The R-T instabilities will grow rapidly during the stagnation phase, and form the structure of “spike-bubble” in different amplitudes around the hot spot. As a result, the symmetry of the hot spot degenerates, and the mix in the hot spot increases. Diagnostics of the high-modes asymmetries of the stagnated hot spot is crucial, but the reliable tools are under development. Considering the size of the hot spot and the motion blur, the imaging diagnostics needs a spatial resolution less than 3μm and a temporal resolution of about 10ps. It is out of the capability of the Kirkpatrick-Baez (KB) microscope with an X-ray framing camera (XFC), which has the resolution of about 7μm and 80ps. In this work, a pulse dilated Wolter-like X-ray microscope is presented. It consists of a Wolter-like microscope and a pulse dilated XFC. The microscope has the Wolter-I type mirror configurations in the sagittal and meridian directions respectively. The object distance is about 20cm. The imaging aberrations are suppressed by the combination of the hyperbolic and elliptical mirrors. The static imaging resolution is less than 2μm in a field-of-view of 400μm. The mirrors use the Pt film and the filter package is set as 30μm Ni and 50μmAl. The maximum reflectivity X-ray energy is around 8keV. To overcome the low resolution of the XFC, the magnification is set as about 25. A pulse dilated XFC is also developed. In the present prototype camera, two CsI cathode chips with a width of 10mm are coated in the center. The exposure time of the pulse on the MCP is about 500ps. So the pulse dilation is set as 50 to decrease the length of the dilation tube. In the test with a fs pulsed ultraviolet laser, the temporal resolution of the pulse dilated XFC is about 10ps and the spatial resolution is about 20lp/mm. The prototype pulse dilated Wolter-like X-ray microscope is installed on the Shenguang-III prototype laser facility. The comprehensive spatial resolution is about 3μm in a field-of-view of 400μm, and the temporal resolution is able to be about 10ps. The performance of the stagnated hot spot imaging will be tested in the following work.

**Keywords:** Wolter-like X-ray microscope, Pulse Dilated X-ray Camera, Stagnated Hot Spot Imaging, High-modes Asymmetry Diagnostics