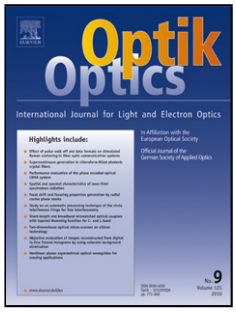

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Automatic alignment of angularly multiplexed beams in excimer laser MOPA system

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Abstract. We present the study on multiplexed beams automatic alignment of high efficiency excimer laser. He-Cd laser with the wavelength of 325nm is selected as the automatic alignment laser at first. And then, the crosshair arrays close to lens array are proposed and designed as the references of near-field and far-field, whereafter array beams are imaged and processed by specific fluorescence imaging system and region segmentation separately. Experiments are carried out in pre-amplifier II with three beams and double passes in excimer laser MOPA system. Results indicate that accuracy of the automatic alignment beam is 0.54% of the diameter of the windows. Meanwhile, the whole process of automatic alignment just takes 40 seconds, which ensures intelligent and high effective integration of automatic alignment system.

Keywords: excimer laser, automatic alignment, crosshair array reference, fluorescence imaging, closed loop feedback control.

1. INTRODUCTION

High power laser facility used for inertial confinement fusion (ICF) is the largest scale laser system. By researchers' investigation and comparison, angular multiplexed excimer laser system with beam smoothing by introduction of spatial incoherence is verified to be a good way to obtain short pulse and perfect target illumination simultaneously. Typically, such excimer laser facility contains a great deal of optical elements, and experiences long distance typically several hundreds of meters or even more. Accordingly, spot size of sub millimeter in diameter is required for most target physics study. In fact, beam pointing is easily influenced by temperature gradient, micro-vibration on ground and optical platforms, mechanical structure worm of the reflectors and lens, etc. In this way, rapid alignment of laser system is needed for operation with high efficiency[1-3]. High power laser facilities such as National Ignition Facility in America[4-6], Laser Mégajoule in France[10] and ShenGuang III in China[8-11], outfit modularize and intelligent automatic alignment system mostly.

Alignment of angular multiplexed beams should ensure all beams to propagate through amplifiers avoiding optical aberrations even crosstalk occurrence. In this way, the beams from the amplifiers can be transferred along the designated direction and accordingly irradiate on the target with high stabilization and accuracy. Generally, automatic alignment system is made up of irradiation laser, near-field and far-field references, images capturing module and servo control mechanism. In the terms