

The output ability promotion of the SG II -Up laser facility

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Abstract

The SG- II -Up laser facility is one of the most important high power laser facilities in china. The maximum output of this facility is studied, and it is improved to 8000J from the design point 5000J.

I. INTRODUCTION

The SG- II -UP laser facility located in shanghai is one of the most important high power laser facilities in china. It is designed to provide output laser energy 40kJ (1 ω) for square pulse of 3ns using 8 laser beams (2 bundles). The above design sepecification has been accomplished in the middle of laser year. After that, the maximum output capacity of this laser facility is studied. According to the following three points: the near field beam quality degeneration as the increasing of the intensity, the far field beam quality degeneration as the increasing of the intensity and the evolution of the maximum modulation point as the increasing of the output energy, the safety boundary of the maximum output of SG- II -Up laser facility is found safely. After that, the maximum output of a single beam is improved to 8000J from the design point 5000J.

II. MAXIMUM OUTPUT OF A SINGLE BEAM

The SG- II -UP laser facility, as shown in Fig.1 and Fig.2, is comprised of 8 identical high power laser beams with the output beam aperture 310mm \times 310mm. It consists of a number of subsystems including the front end, preamplifier, main amplifier, final optics assembly, target chamber and diagnostic subsystem, beam control and diagnostic subsystem, and integrated computer control subsystem, more information could be found in [1-4].

In order to find the maximum output capacity of this laser facility safely, the 160ps short pulse situation is studied first. Fig. 3 (a) and (b) show the near field and far field of one beam when the output intensity reaches 5.2GW/cm². Fig 4 shows the fluence beam contrast (FBC) as the increasing of the intensity. It shows that the beam near filed become better as the increasing of the output intensity when the intensity is no greater than 4.3GW/cm². But it become worse as the increasing of the output intensity after that point. When the intensity is 5.2GW/cm², the FBC is about 0.11, which means that the near filed beam quality is not dangerous for the laser system, but cannot be increased. Fig. 5 shows that the far field beam quality is still steady even for the 5.2GW/cm²

intensity. The above results show that the 5.2GW/cm² intensity is an appropriate safe border for this facility. Based on the above results, the output of the 3ns pulse duration is improved gradually. Fig. 6 shows the situation of the beam modulation as the increasing of the output energy. The maximum output is up to 8050J without optics damage, and it is being further improved by other measures, such as the twice shaping. Fig. 8 shows the near field and far field of the 8050J output for square pulse of 3.4ns.

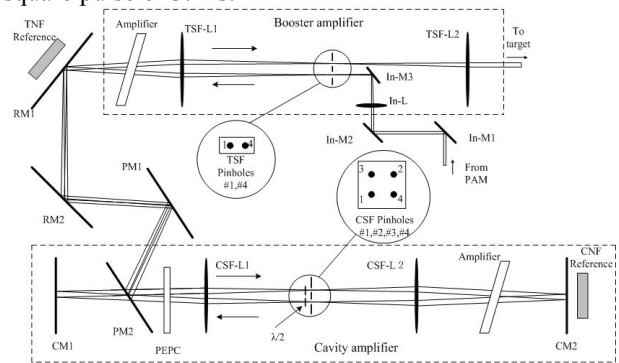


Fig. 1. Schematic of the main amplifier.



Fig. 2. The laser bay.

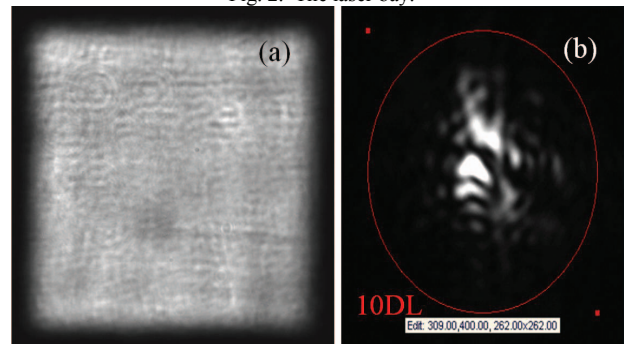


Fig. 3. near field (a) , far field (b) when the output intensity reaches 5.2GW/cm².

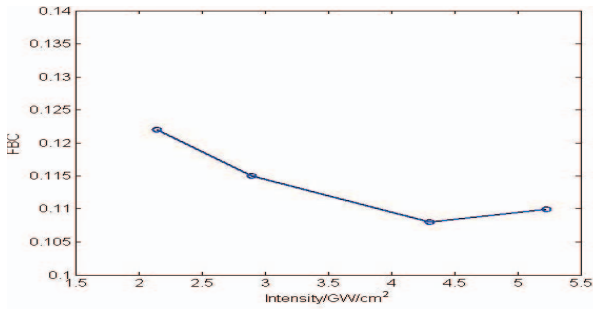


Fig. 4. FBC as increasing of intensity

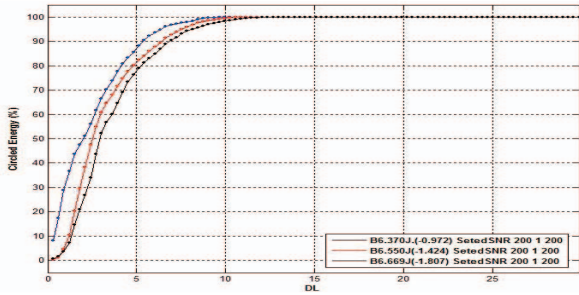


Fig. 5. Encircled energy for different output energy

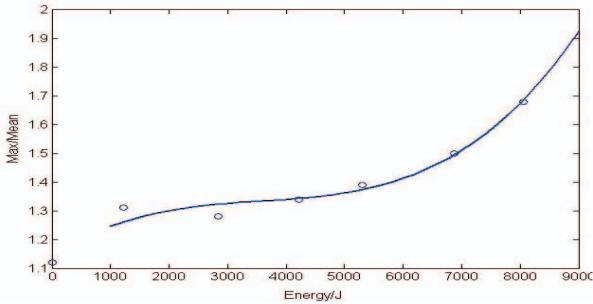


Fig. 6. Maximum modulation as increasing of output energy

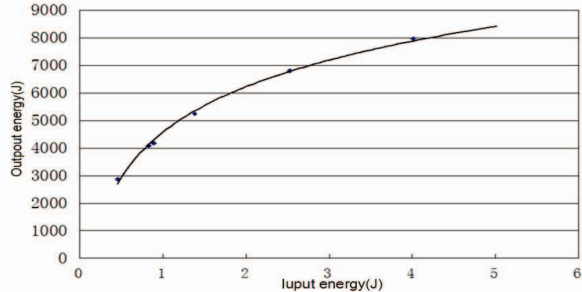


Fig. 7. The output energy as increasing of input energy

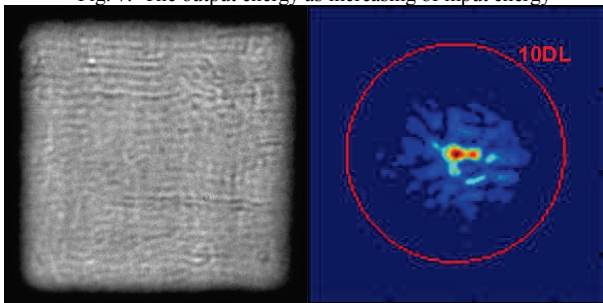


Fig. 8. Near field and far field when the output energy is 8000J

III. CONCLUSIONS

Based on the above three points: the near field beam quality degeneration as the increasing of the intensity, the far field beam quality degeneration as the increasing of the intensity and the evolution of the maximum modulation point as the increasing of the output energy,

the safety boundary of the maximum output of SG II -Up laser facility is found safely. After that, the maximum output of the single beam is improved to 8000J from the design point 5000J, and the further improving is ongoing.

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