

Laser Amplifier

High energy pulsed & high average power diffraction-limited laser amplifier

Reference No. P 165

BACKGROUND

A number of scientific applications at accelerator facilities as well as in industrial applications require lasers that are simultaneously capable of producing high energy pulses and high average power. An improved laser amplifier apparatus emitting joule-level laser pulses together with kilowatt average-power output would offer new applications in science as well as in industry, e.g. strengthening of gears and valves, the drilling at high angles of fuel injectors and turbine blade cooling passages, etc., in automotive industry which could make these processes available to mass market. However, the available technologies offer either lasers which handle high power or high energy only.

SOLUTION

The innovative laser amplifier is capable of producing joule-level laser pulses together with kilowatt average-power output. The key components to this technological achievement are the composite-thin-disk gain-element and the assembly, which is arranged in a multi-pass beam path configuration. An improved cooling efficiency of the gain medium is achieved by folding the resonator beam path which results in a number of advantages listed below.

ADVANTAGES

- Enabling the amplification of joule-level gigawatt laser pulses while avoiding optical damage
- Simultaneously operating at kHz repetition rates steadily
- Durability
- Works with standard laboratory electrical power and cooling infrastructure
- Compact configuration which can be adapted to spatial requirements in a routine application

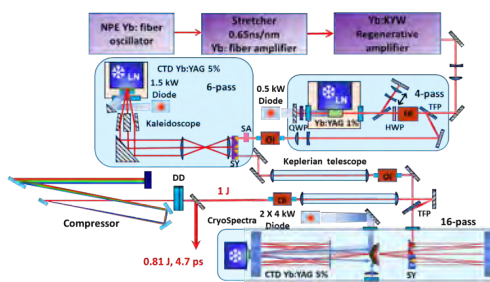


Fig. 1: 1-Joule laser schematic. TFP, thin-film-polarizer; FR, Faraday rotator; HWP, half wave plate; LN, liquid Nitrogen Dewar; Ol, optical.

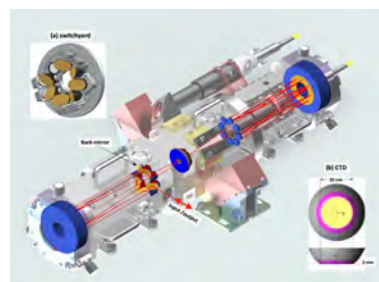


Fig. 2: 3D image of the 16-pass amplifier unit and the ray trace overlay with main optical components; (a) Switchyard; (b) CTD.

APPLICATION FIELDS

Applications in accelerator facilities such as:

- Optical parametric chirped pulse amplification
- Inverse Compton scattering
- High energy THz generation

Industrial applications such as:

- Material processing
- Laser peening
- Percussion drilling
- Laser trepanning

PROPERTY RIGHTS

US 2022376456 A1
EP 4092847 A1

POSSIBILITIES OF COOPERATION

- Licensing
- R&D Cooperation

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