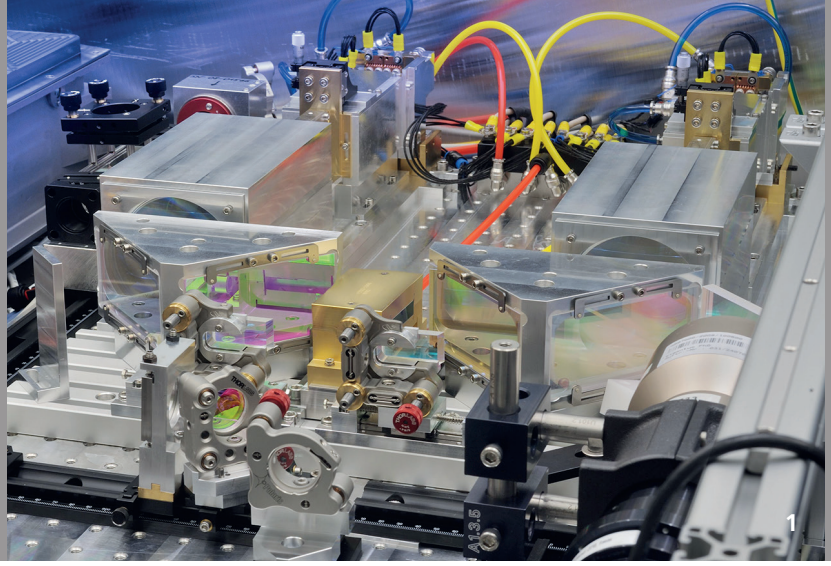

SCALING THE PULSE ENERGY OF INNOSLAB AMPLIFIERS

Task

When the LIDAR method is used to detect trace gases or measure wind speeds in the atmosphere, its signal-to-noise ratio is dependent on the available laser pulse energy. For satellite-borne measuring systems, pulse energies of several to more than 100 mJ are generally desirable, having repetition rates of 100 Hz and a wavelength adapted to the specific measuring task. To achieve spatially resolved measurements of the air column at an acceptable signal-to-noise ratio, a pulse energy of more than 400 mJ is required at a wavelength of 1 µm. So that such a beam source can be used on a satellite, it must be efficient and able to be built in a compact and robust design, while retaining high beam quality.

Method

Fraunhofer ILT has designed and constructed a demonstrator model of an oscillator-amplifier chain. Two INNOSLAB amplifier stages were used to achieve the desired total amplification and pulse energy. The institute built the demonstrator model based on its developments on highly stable optomechanical components for satellite use. The concept is compatible with the robust and compact »FULAS« platform (Future Laser System). ESA has funded its development as a platform for future satellite-borne lasers.

Result

Containing Nd:YAG as a laser crystal, the demonstrator model has generated longitudinal single-mode laser pulses with pulse energies of over 500 mJ and bandwidth-limited pulse durations of 30 ns at a 100 Hz pulse repetition rate and a wavelength of 1064 nm. The pulse energy is produced in only two INNOSLAB amplifier stages from 8 mJ pulse energy of the oscillator. The optical efficiency of the chain is over 22 percent. After passing the second amplifier, the beam is nearly diffraction limited in both directions at maximum pulse energy ($M^2 < 1.5$).

Applications

After the scalability of the platform FULAS has been successfully demonstrated, the beam source will be used as a pump source for an optical parametric oscillator with an output wavelength of 1.65 µm. The total system should be used as a testing laser on a measuring station to determine the laser-induced damage threshold of optical components at 1 µm and 1.65 µm.

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1 500 mJ INNOSLAB amplifier.

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