



COMPACT LASERS FOR AIRBORNE LIDAR SYSTEMS

Task

A long-term goal of climate research is to determine all climate-relevant variables continuously and globally with high spatial resolution. This kind of data will in future be generated by satellite-based LIDAR systems. The use of airborne systems as technology demonstrators is an important step toward achieving this goal.

To this end, a beam source for measuring wind-speed profiles is being developed together with three pump beam sources for CO₂ and CH₄ density measurements. They meet the particular requirements of efficiency, compactness, robustness and safety associated with use in aerospace applications.

Method

The four lasers were designed as MOPA systems, some of them multistage, with Nd:YAG crystals. Spectral beam properties are generated in an oscillator in longitudinal single-mode operation with low pulse energy (~ 10 mJ) and then amplified in INNOSLAB amplifier stages to 100 - 200 mJ. The target wavelength required for the particular application is generated in a frequency converter stage. The optical components are arranged in a compact configuration on both sides of a monolithic support structure that was optimized by means of FE simulations. The tilt properties of the individual

optomechanical components were tested, analyzed and optimized under vibration loads and temperature variations at Fraunhofer ILT.

Result

In line with requirements, stable single-mode operation of the integrated oscillators was demonstrated at pulse energies of 8 - 10 mJ, a repetition rate of 100 Hz and a pulse duration of 35 ns as well as amplification to 75 mJ in an initial amplifier stage. The four laser systems will be handed over to the respective project partners in 2013.

Applications

In the field of climate research, modifying beam parameters such as wavelength allows other climatic variables to be recorded in addition to the aforementioned measuring tasks. This technology can also be used in the industrial sector for monitoring industrial plant, checking gas pipes for leaks or measuring wind fields. The compact, robust design can be used for beam source development across a wide range of systems.

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1 Oscillator and INNOSLAB amplifier of the pump beam source for the CH₄ measuring system.