



FULAS – LASER PLATFORM FOR FUTURE SATELLITE-BASED LIDAR SYSTEMS

Task

Satellite-based instruments for atmospheric research (LIDAR) enable scientists to measure the climatically relevant distribution of aerosols, wind or greenhouse gases such as carbon dioxide, methane and water globally. These instruments require a tailor-made laser beam of the highest beam quality which emits pulses with energies in the 10 mJ or 100 mJ range at a particular wavelength. The pulses have a bandwidth-limited duration of a few 10 ns and are typically repeated at 100 Hz, but anywhere from 10 Hz to a few kHz can also be necessary. Decisive is generally an energy demand as low as possible. Construction of these complex laser sources with the reliability and lifetime required for operation in space has proved extremely challenging in recent years.

Method

As part of the »FULAS« project and in cooperation with Airbus, Fraunhofer ILT has developed a laser that demonstrates novel technologies in this context. Soldering techniques for mounting and adjusting the laser optics enable the laser to withstand environmental influences easily. By dispensing with critical organic and outgassing materials, we prevent laser-induced contamination. The laser source consists of a cavity-controlled seeded actively Q-switched diode-pumped Nd:YAG oscillator and an INNOSLAB amplifier.

1 FULAS laser head in operation.

2 Inner view of the FULAS laser head.

Results

The laser was integrated into the system up to the expansion stage which has 90 mJ pulse energy at 1064 nm wavelength and meets all laser-optical requirements of the ATLID instrument on the ESA EarthCARE satellite. A multi-week operational and non-operational (-30 °C to 50 °C) test was successfully completed in a thermal vacuum chamber at Airbus Defence & Space.

Applications

The FULAS platform allows beam sources to be generated with currently up to 500 mJ at 1064 nm. Wavelengths from UV to MIR can be provided with high efficiency and beam quality by means of frequency converters. A preliminary design for the laser beam source of the MERLIN instrument has been developed based on the FULAS platform. According to current plans, this Franco-German satellite will be launched in 2021. It shall measure the global distribution of methane, a gas relevant to the climate change.

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Contact

Dipl.-Phys. Jörg Luttmann
Telephone +49 241 8906-675
joerg.luttmann@ilt.fraunhofer.de

Dipl.-Ing. Hans-Dieter Hoffmann
Telephone +49 241 8906-206
hansdieter.hoffmann@ilt.fraunhofer.de