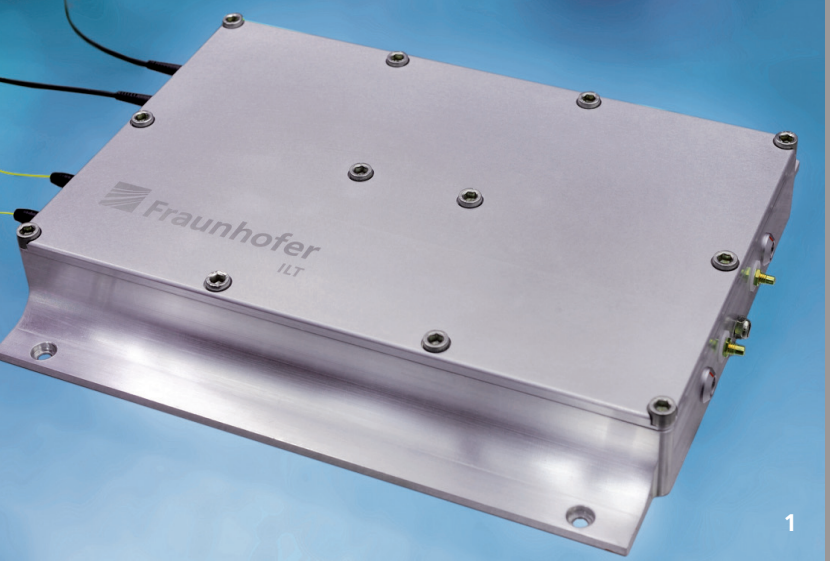
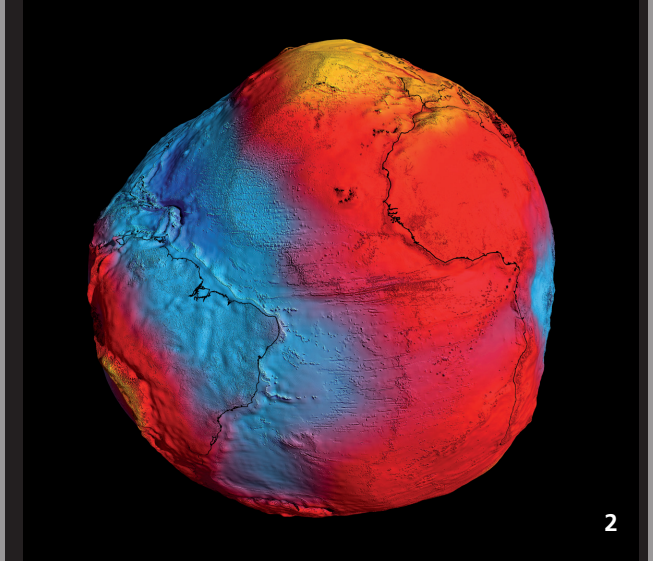


1



2

HIGHLY STABLE FIBER AMPLIFIER FOR NARROW-BAND SIGNALS

Task

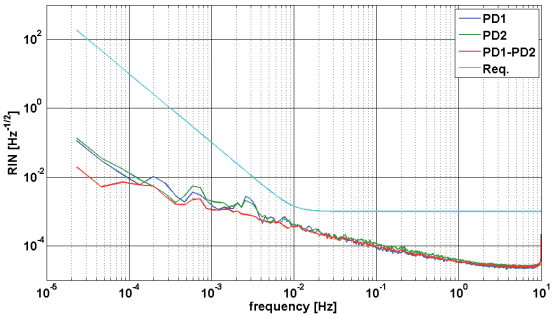
As part of its Earth Observation program, the European Space Agency is overseeing missions to measure the gravitational field of the earth. In order to improve the measurement resolution from previous missions (GRACE), it is developing a laser at 1064 nm, which exhibits a spectral bandwidth below 10 kHz and extremely high operating stability.

Method

The beam source consists of a fiber amplifier developed by Fraunhofer ILT, which scales the signal of a non-planar ring oscillator to the desired output power, and a reference cavity developed by the project partner, which stabilizes the laser in the frequency. The active medium of the amplifier is a polarization-maintaining fundamental-mode fiber with step index profile. This is pumped with a spectrally stabilized laser diode at a wavelength of 976 nm in order to counteract the occurrence of stimulated Brillouin scattering. By means of a photodiode and a customized, high-resolution electronics, the output power of the laser can be actively stabilized by modulating the pump power.

Result

The required output power of 500 mW could be successfully demonstrated while maintaining the stability criteria. At a central wavelength of 1063.9 nm, the amplifier was stabilized



Output power stability.

to a bandwidth below 3 kHz at full output power at a project partner. The degree of polarization is above 99 percent. Through the use of fundamental-mode fibers, the beam quality achieved amounts to M^2 <1.1.

Applications

Due to the extremely narrow bandwidth and power stability as well as the high transverse beam quality, the amplifier is suitable for use as a beam source in various areas of industrial metrology, in addition to satellite-supported gravimetry and communication.

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1 Fiber-amplifier module.
2 Local distribution of the gravitational field of the earth, source: © ESA/HPF/DLR, GOCE mission.

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