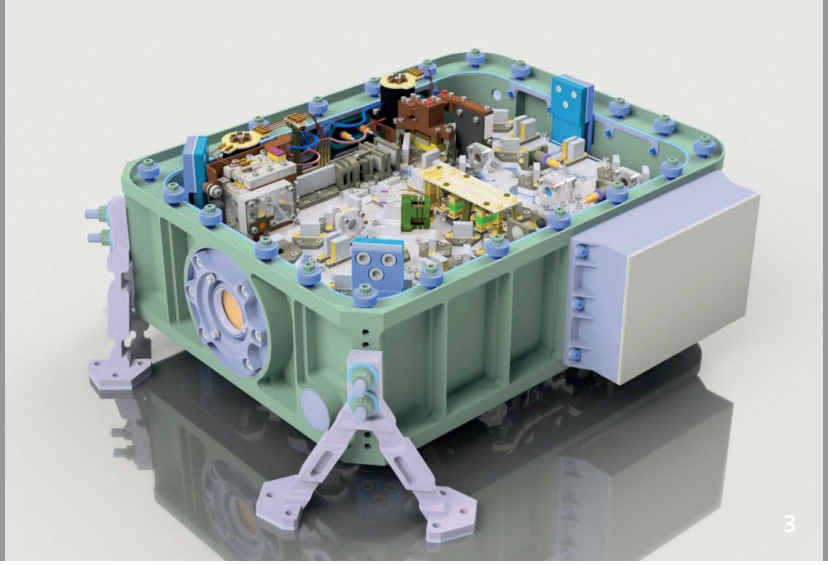

LASER DESIGN FOR THE MERLIN MISSION

Task

The global distribution of greenhouse gas methane shall be monitored from 2021 onwards using the IPDA (Integrated Path Differential Absorption) method within the scope of the Franco-German climate mission »MERLIN« (Methane Remote Sensing LIDAR mission). In this active measurement method, a laser source emits light pulses with very specific characteristics, thus making it possible to draw conclusions on the methane quantity between the satellite and the earth's surface by simply measuring the quantity of backscattered light. However, for use on a satellite, the system must be able to withstand a great range of temperatures and vibrations and have a service life of more than three years. This also means that all components must be designed to be extremely low outgassing.

Method

Over the past few years, a technology has been systematically developed which allows the construction of the appropriate laser source. Requirements for optomechanical fastening elements have been derived and corresponding key elements (such as holders for mirrors, lenses, different crystal types) as well as processes have been developed and tested. The core process in this case is the adjustment soldering, with which the mirrors can be precisely adjusted and then be joined with great robustness and without needing adhesives. In addition, the entire assembly technology was validated using the platform demonstrator »FULAS« as was the optical design of the MERLIN laser in breadboard studies.

Results

The laser source consists of an Nd:YAG-based setup arrangement consisting of a rod oscillator and an INNOSLAB amplifier with a subsequent parametric frequency converter for 1645 nm. A preliminary design was developed and the PDR (preliminary design review) status was achieved. Based on this, the detailed design of the final flight model is currently being developed.

Applications

The structural concept of the laser as well as the model philosophy applied to the flight model can, in principle, be transferred to other requirements and systems. The development risks are greatly reduced by using previously tested key components. In addition to application fields in aerospace, the principle can be applied to all areas where reliability and long-term stability play a very important role.

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3 Image of the MERLIN laser generated from the 3D model.