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LIDAR EMITTER AND MULTI-SPECIES GREENHOUSE GASES OBSERVATION INSTRUMENT (LEMON) : ADVANCES ON A MULTI-SPECIES DIFFERENTIAL ABSORPTION LIDAR SYSTEM

Abstract

In the frame of LEMON project (Lidar Emitter and Multi-species greenhouse gases Observation instrument - European Union's Horizon 2020 research and innovation program 821868), we are developing a multi-species differential absorption Lidar (DIAL). The goal is to benefit from innovative technological developments in terms of optical emitter, spectral reference, to be able to address H₂O and its isotope HDO at 1982 nm, CO₂ at 2051 nm, and potentially CH₄ at 2290 nm, for future ground-based range-resolved or airborne integrated-path DIAL. The potential of the technologies for future space operation is also addressed via environmental testing of some components and sub-units. The infrared emitter is based on the combination of two specific, patented, no-seeder Nested Cavity OPOs (NesCOPOs) coupled to a single optical parametric amplifier (OPA) line for high energy pulses generation. This configuration is enabled by the use of high aperture periodically poled KTP crystals (PPKTP), specifically developed for the project, which provide efficient amplification in the spectral range of interest around 2 μ m, with slight temperature adjustments. Specific developments are also pursued on the frequency reference for the emitter, which is planned to be provided by a GPS referenced frequency comb with large mode spacing (1 GHz) against which the emitter output pulses can be heterodyned. Specific tests experiments have been carried out, covering a wide panel of activities : radiation testing of some critical components, NesCOPO and OPA testing, preliminary DIAL tests with laboratory test-beds and comparison with specific in-situ calibration instruments. The final instrument design was carried out and the sub-units are now being built. The presentation will give an overview of the key elements of design and of preliminary experimental characterizations of sub-systems building blocks. LEMON project was supported by European Union's Horizon 2020 research and innovation program 821868, under the programs H2020-EU.2.1.6.1. - Enabling European competitiveness, non-dependence and innovation of the European space sector and H2020-EU.2.1.6.2. - Enabling advances in space technology. Within the Earth Observation Technologies topics, other complementary developments, such as HOLDON and SCARBO projects, were also funded. Abstracts on these two projects were also submitted to the IAC B1 Earth Observation Symposium.