Microsecond-pulse master oscillator – power amplifier at 828 nm for a water-vapor differential absorption lidar

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Abstract: We describe the design and characterization of a master oscillator – power amplifier laser system operating under µs-pulse regime at 828 nm, with a view to its integration in a low cost, eye safe and autonomous airborne differential absorption lidar for tropospheric water-vapor measurements. The output energy of the amplifier system reaches 6.2 µJ per pulse.

Introduction[1,2]:
- The climate and weather phenomena are reflected by the rapid changing spatial and temporal distribution of water-vapor in the troposphere (≤15km).
- Airborne differential absorption lidar (DIAL) operating at a water absorption line is a good candidate of range-resolved atmospheric measurements.
- DIAL: a self-calibrated technique that sends two laser pulses of different wavelengths (one at the absorption feature, the other one off) to the atmosphere and retrieves the molecule information from the backscattered signals.

Experimental setup

TSOA performance

Beam shape after axicon pairs[3]

Summary:
- TSOA output pulse: 1µs, 10kHz, 6.2µJ, good beam quality M² = 5.3 × 2.5
- Transmission efficiency through the telescope = 83%

Outlooks:
- Obtain preliminary ground-based DIAL signals
- Airborne mission
- Increase the pulse energy → improve lateral resolution by replacing the signal TSOA by a module of coherently combined TSOA amplifiers[4]

References