A 2-micron Pulsed Laser Transmitter for Direct Detection Column CO_2 Measurement from Space

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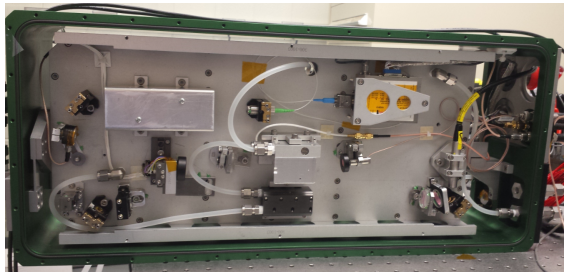
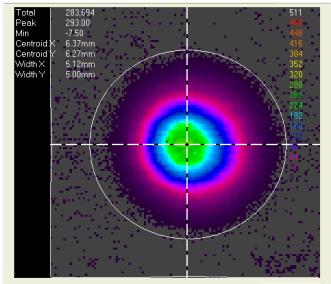
Objective

- Develop a compact, efficient two-micron pulsed laser for a lidar instrument to make accurate, high-resolution atmospheric CO_2 column measurements in support of the ASCENDS mission.
  - Develop a pulsed two-micron laser that is based on a Thulium fiber-laser pumped Holmium (Ho) solid state laser in a Master Oscillator Power Amplifier (MOPA) configuration.
  - Demonstrate > 35mJ at 100-200Hz needed for the space Integrated Path Differential Absorption (IPDA) instrument in a robust prototype format.



Thulium Fiber laser pumped Holmium-only two micron laser in a ring cavity configuration with demonstrated operation at pulse repetition rates from 100-1 kHz at output powers from 4-8 Watts



Injection seeded, single frequency beam profile

Accomplishments

- Designed and built a compact, injection seeded, 13.8% optical-to-optical efficiency, two-micron pulsed laser for a CO_2 column measurement lidar instrument.
  - Completed optical, mechanical, and electrical integration of a compact, highly stable ring-cavity 2-micron laser.
  - Completed functional characterization of the laser performance operated over a range of pulse repetition rates that enable multiple measurement architectures.
  - Achieved greater than 8 W output power at less than 35 W pump power demonstrating the most efficient laser of its kind to date.
  - Verified single frequency operation by injection seed technique. The beam quality value achieved M^2 <1.1.
- The laser is ruggedized and built for deployment in trailer or aircraft operation.

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TRL_{in} = 3 TRL_{out} = 4