A Compact Remote Sensing Lidar for High Resolution Measurements of Methane

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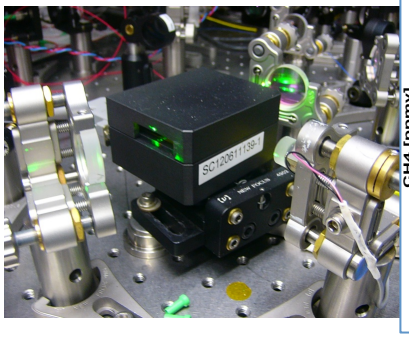
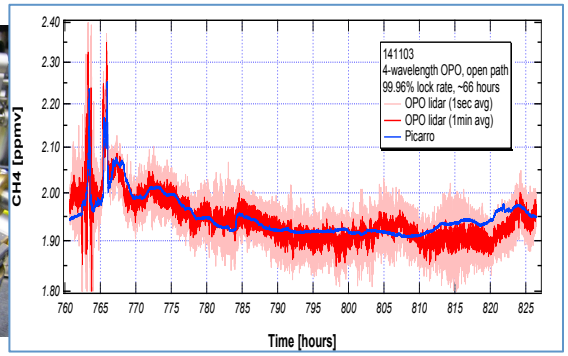
Objective

- Develop a compact, space-qualifiable laser transmitter for a lidar operating at 1.65 μm to enable CH_4 measurements with performance goals of:
  - Output energy greater than 300 μJ
  - Linewidth less than 500 MHz
- Reduce the risk, cost, size, mass and volume of the CH_4 lidar instrument by scaling the laser power of the existing laboratory breadboard
- Demonstrate and validate high sensitivity CH_4 open path measurements



5-Wavelength OPO



65 hour CH_4 LIDAR measurement correlated with in-situ Picarro instrument

Accomplishments

- Demonstrated two viable architectures for a CH_4 transmitter using a burst mode Optical Parametric Amplifier (OPA) and a multi-wavelength Optical Parametric Oscillator (OPO)
  - With a 5-wavelength OPO, obtained 250 μJ/pulse @ 5 KHz and linewidth ~300 MHz
  - With an OPA, obtained 290 μJ/pulse @ 10 KHz and linewidth ~ 500 MHz
- For both OPA and OPO architectures, demonstrated and validated CH_4 open path measurements using an in-situ Picarro instrument for correlation
- Designed an integrated CH_4 lidar to be used in an airborne demonstration using GSFC transmitters (OPO version) and an ESTO-developed (IIP) sensitive detector
- Collaborated within GSFC and outside vendors and leveraged IRAD and SBIR to develop alternative transmitter architectures (Er:YAG and Er:YGG) to increase transmitter efficiency and energy, and possibly simplify implementation

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TRL_{in}=2 **TRL_{out}=4**