Differential Absorption Measurements of Carbon Dioxide and Diatomic Oxygen

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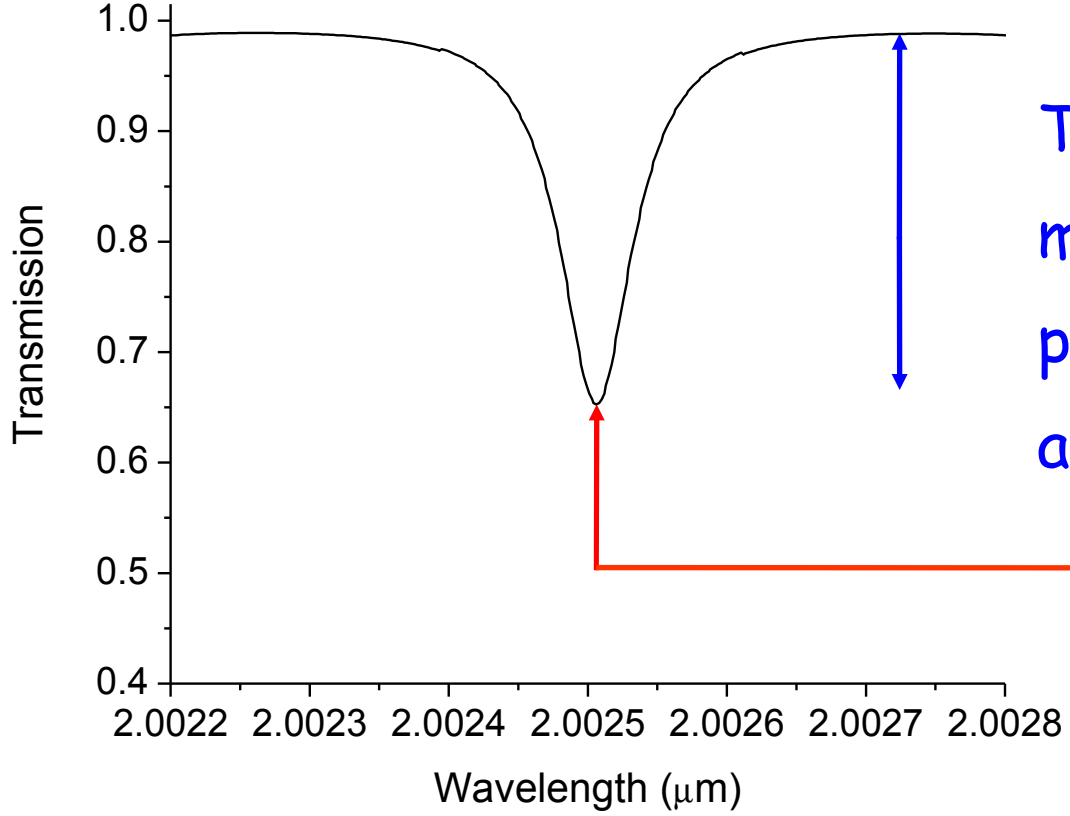
Outline

- Molecular Absorption
- CO_2 Instrument
- Natural CO_2 Variation
- O_2 Instrument
- Results and Future Work

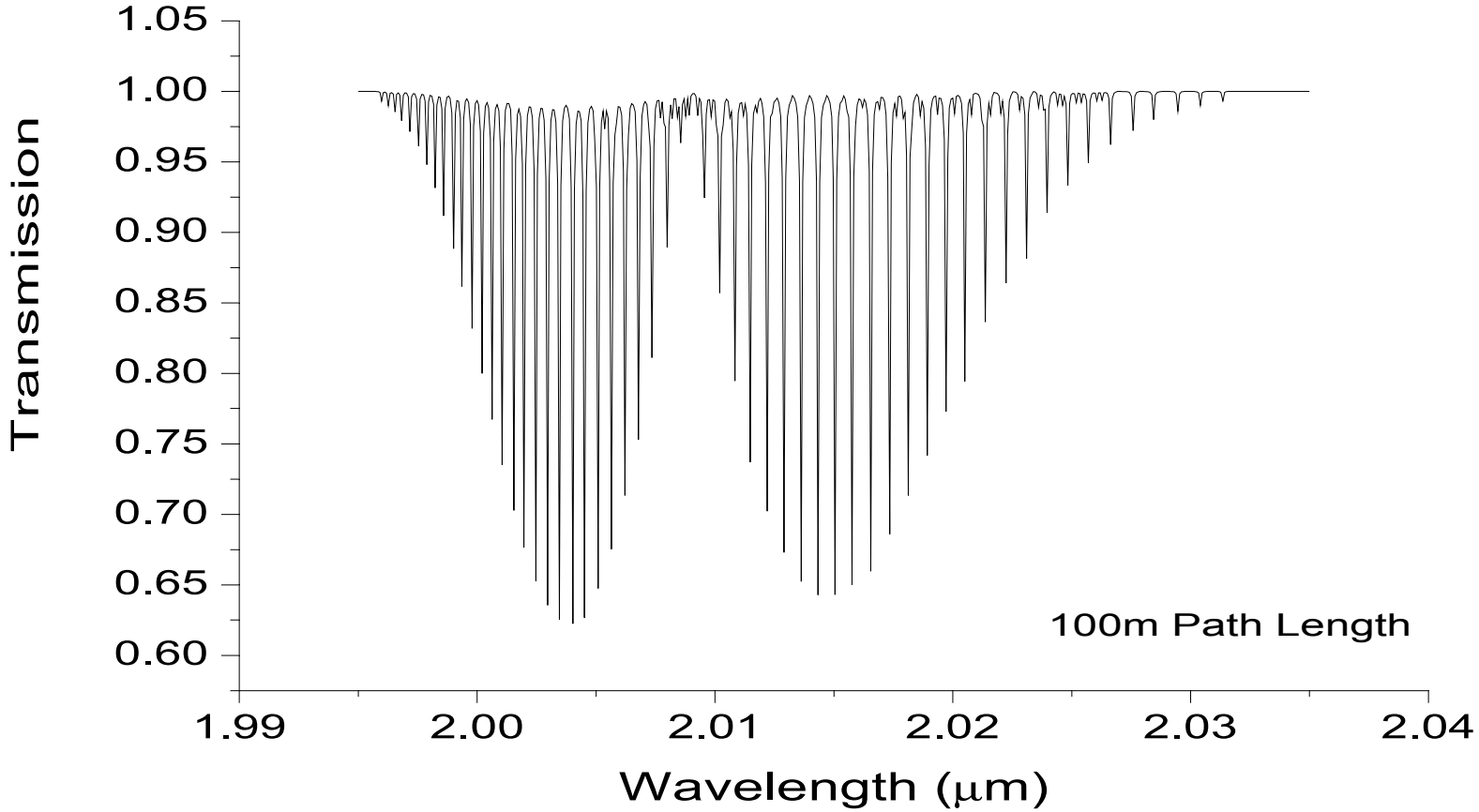
Molecular Absorption



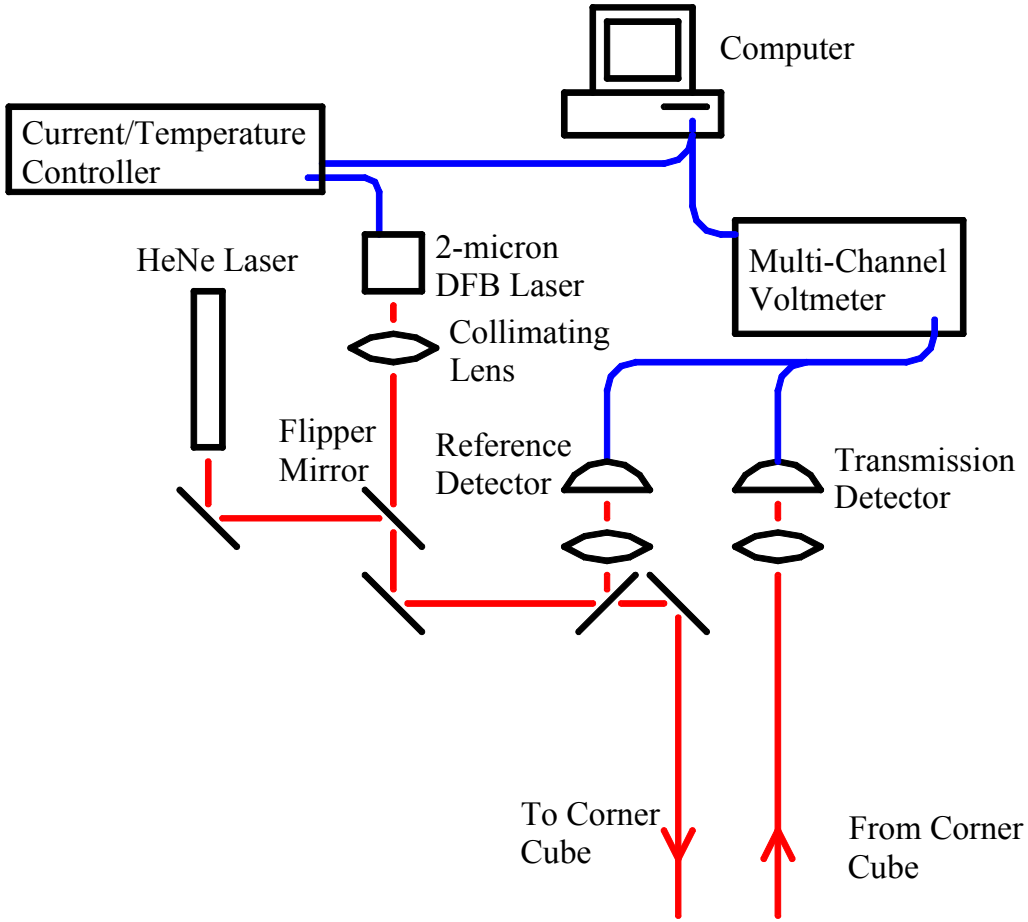
The number of molecules in the optical path is related to the amount of absorption.

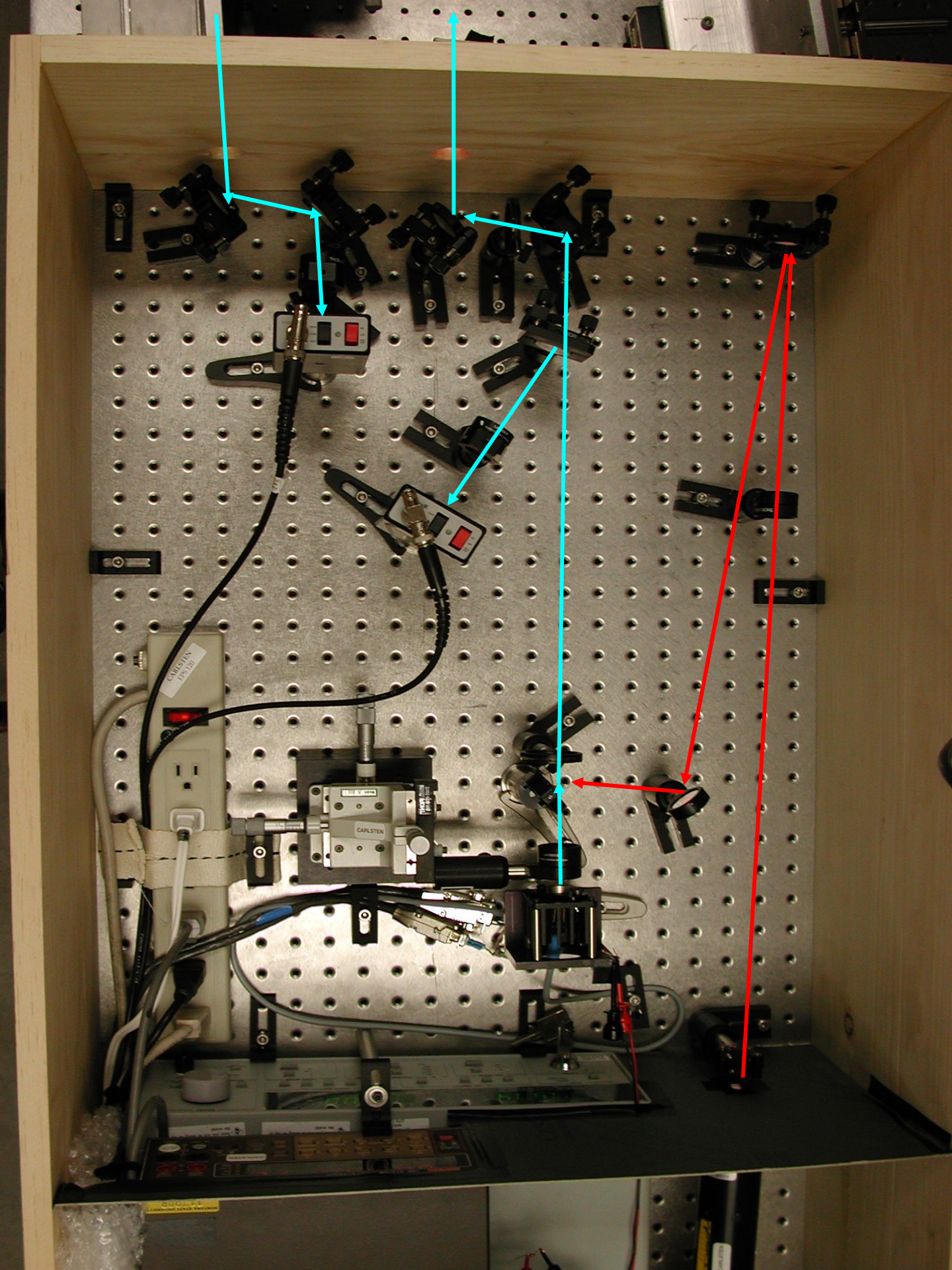
The molecule can be identified by this wavelength.

CO_2 Instrument



CO_2 Instrument

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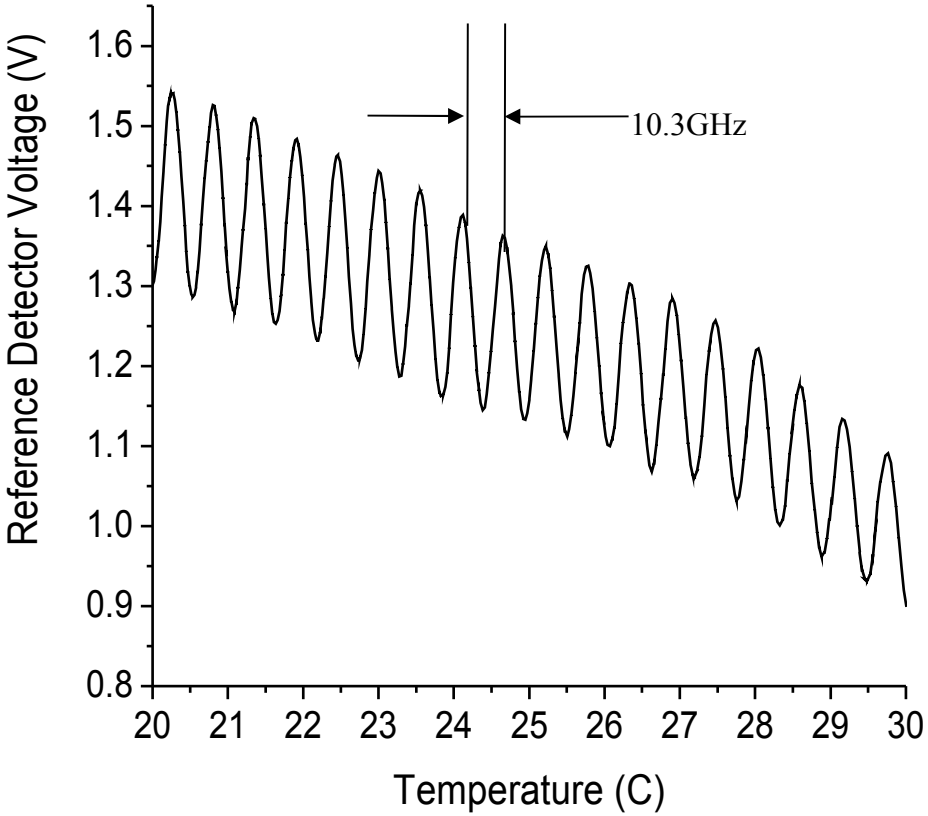
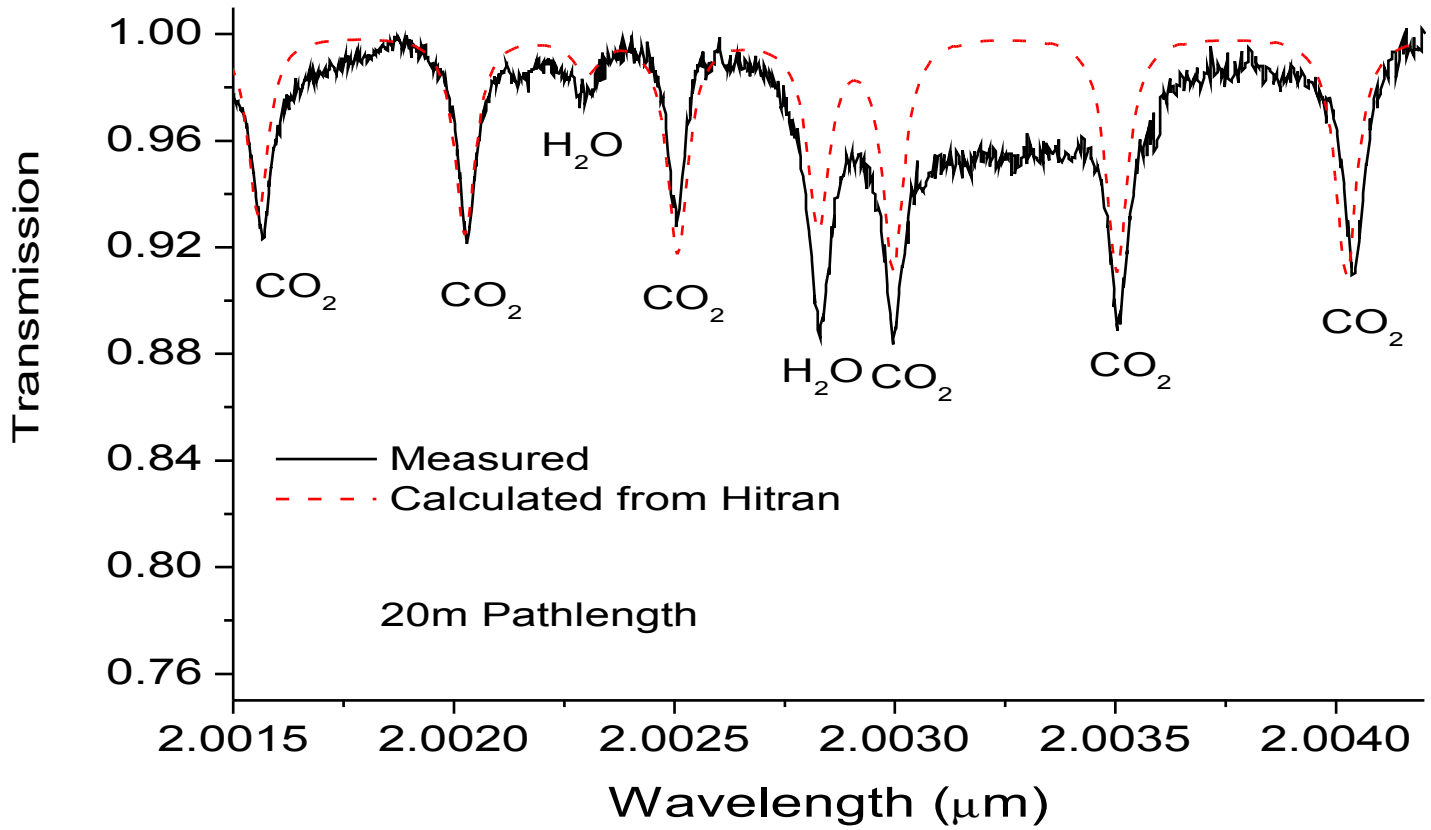
CO_2 Instrument

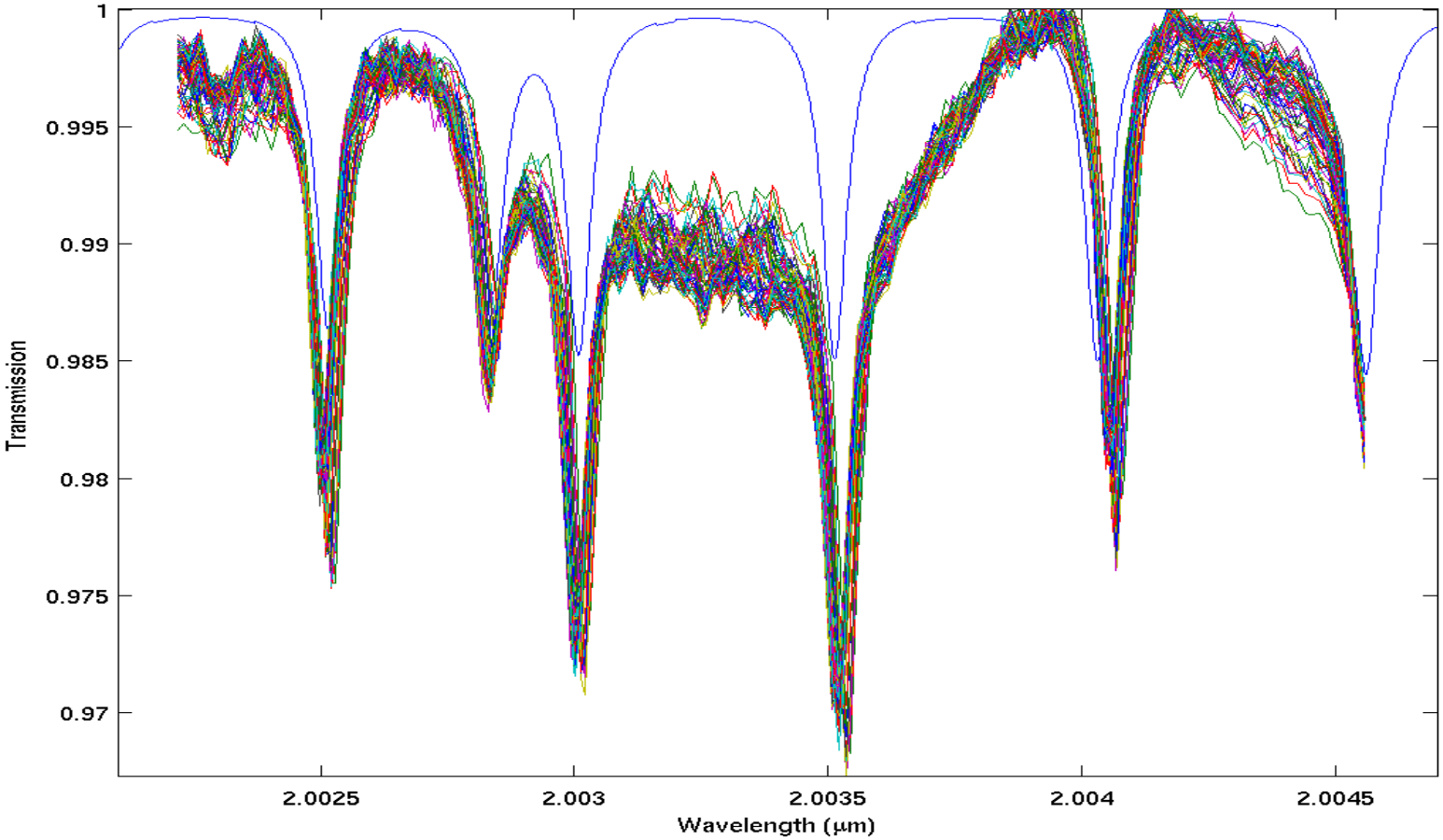
- Temperature affects lasers wavelength.
- Fabry-Perot etalon used to measure laser tuning rate.
- Tuning Rate is ~19.7GHz per °C.
- Continuous Tuning range is ~3.5nm.



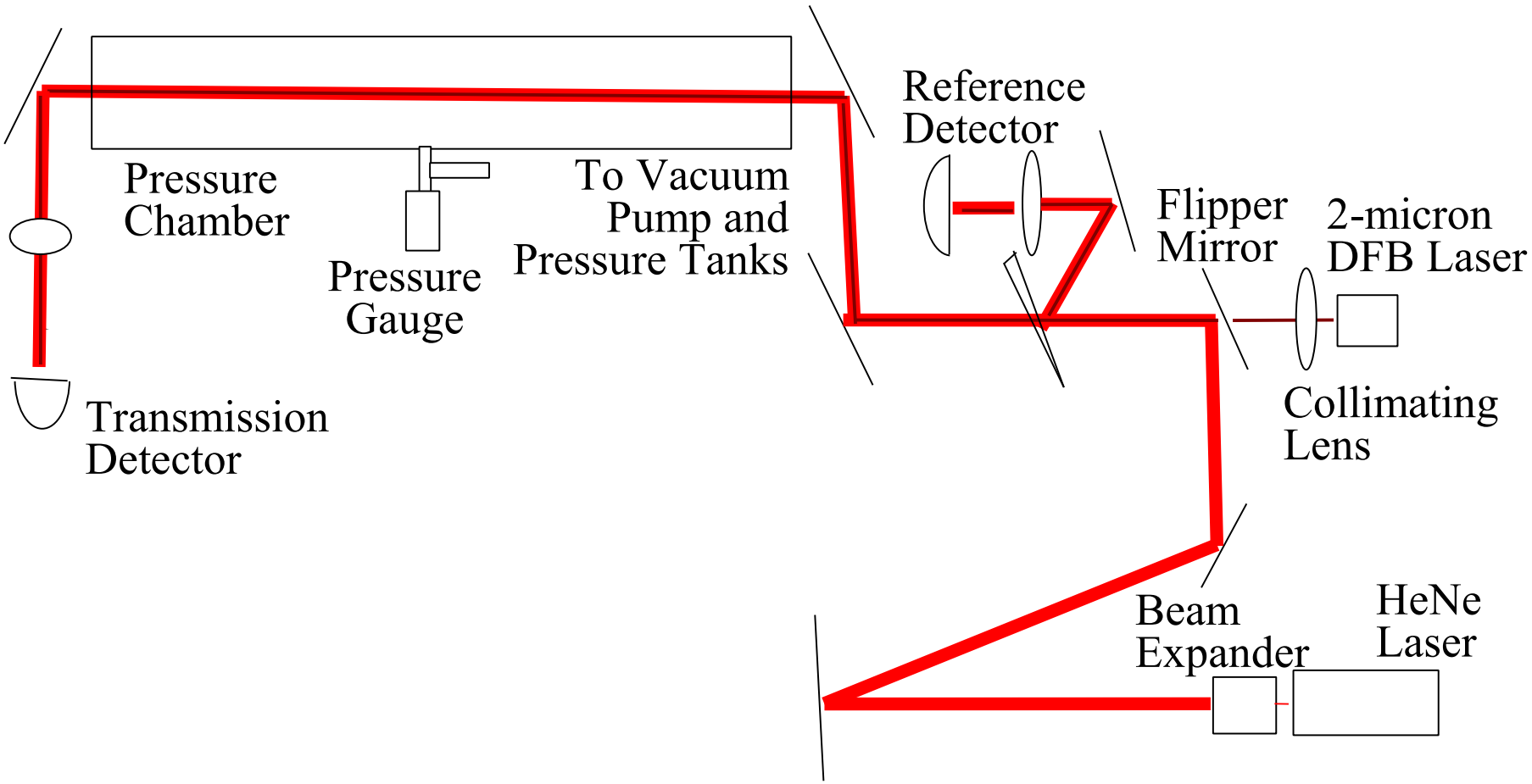
CO_2 Instrument



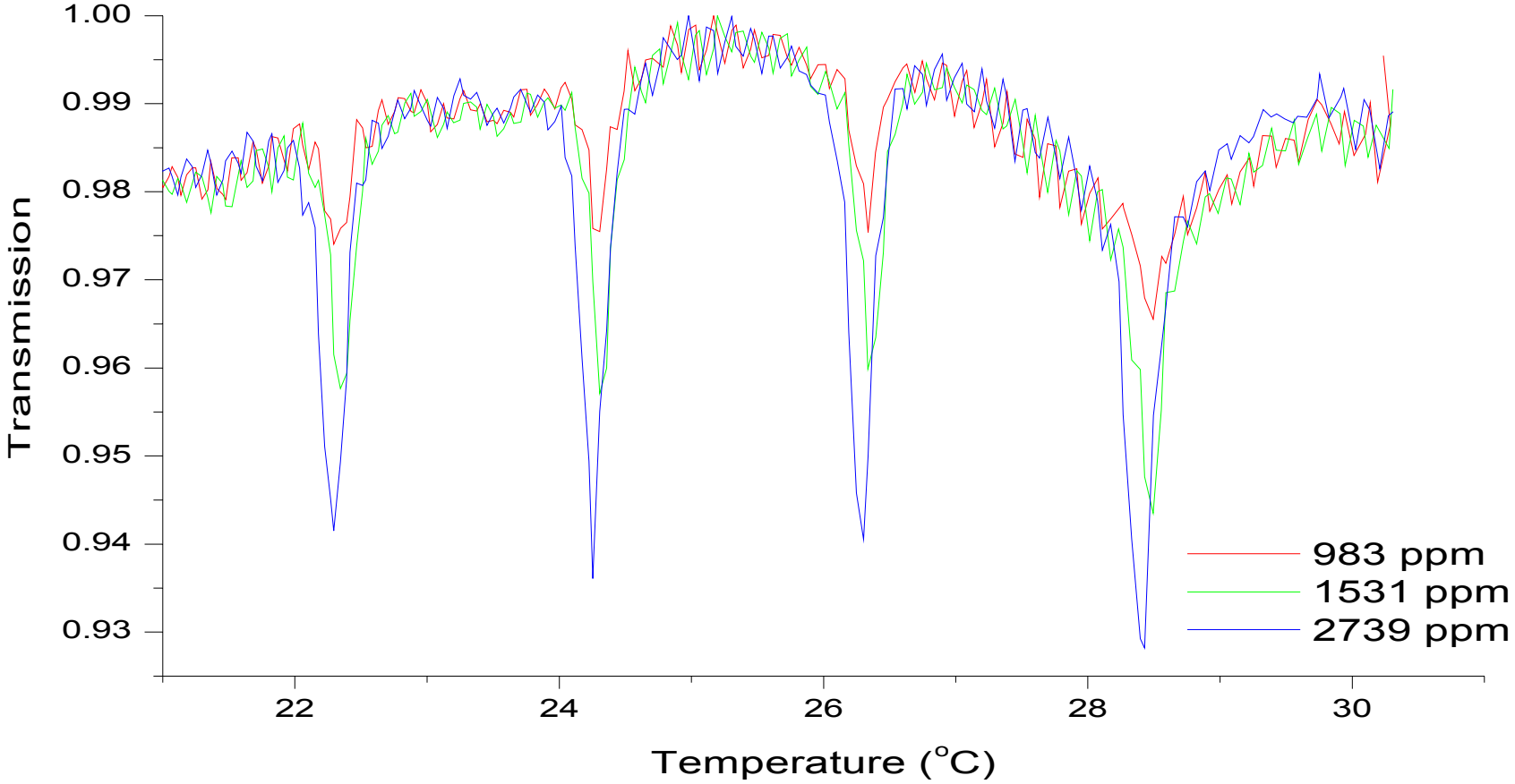
CO_2 Instrument



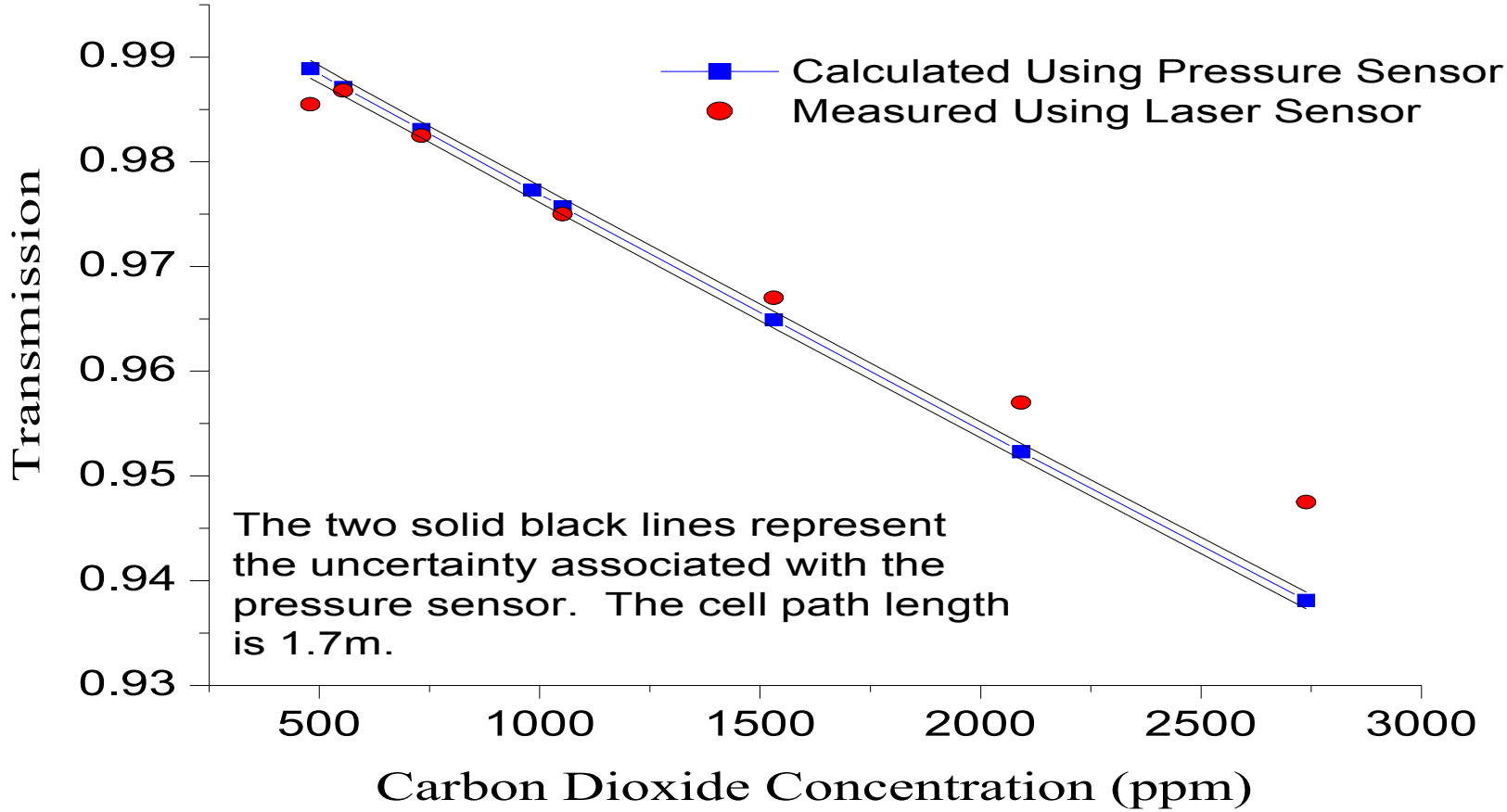
CO_2 Instrument



CO_2 Instrument



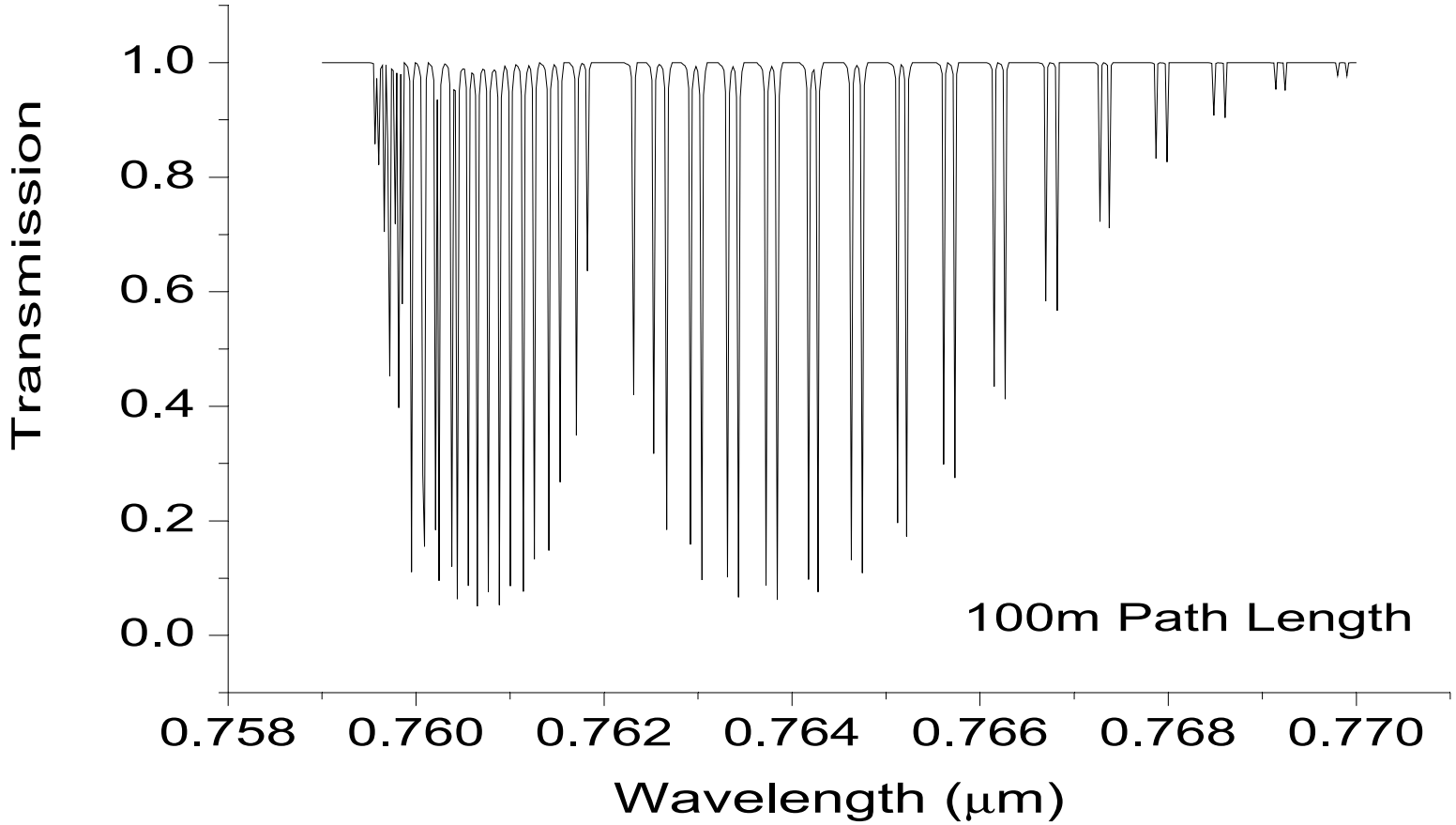
CO_2 Instrument



Natural CO_2 Variation

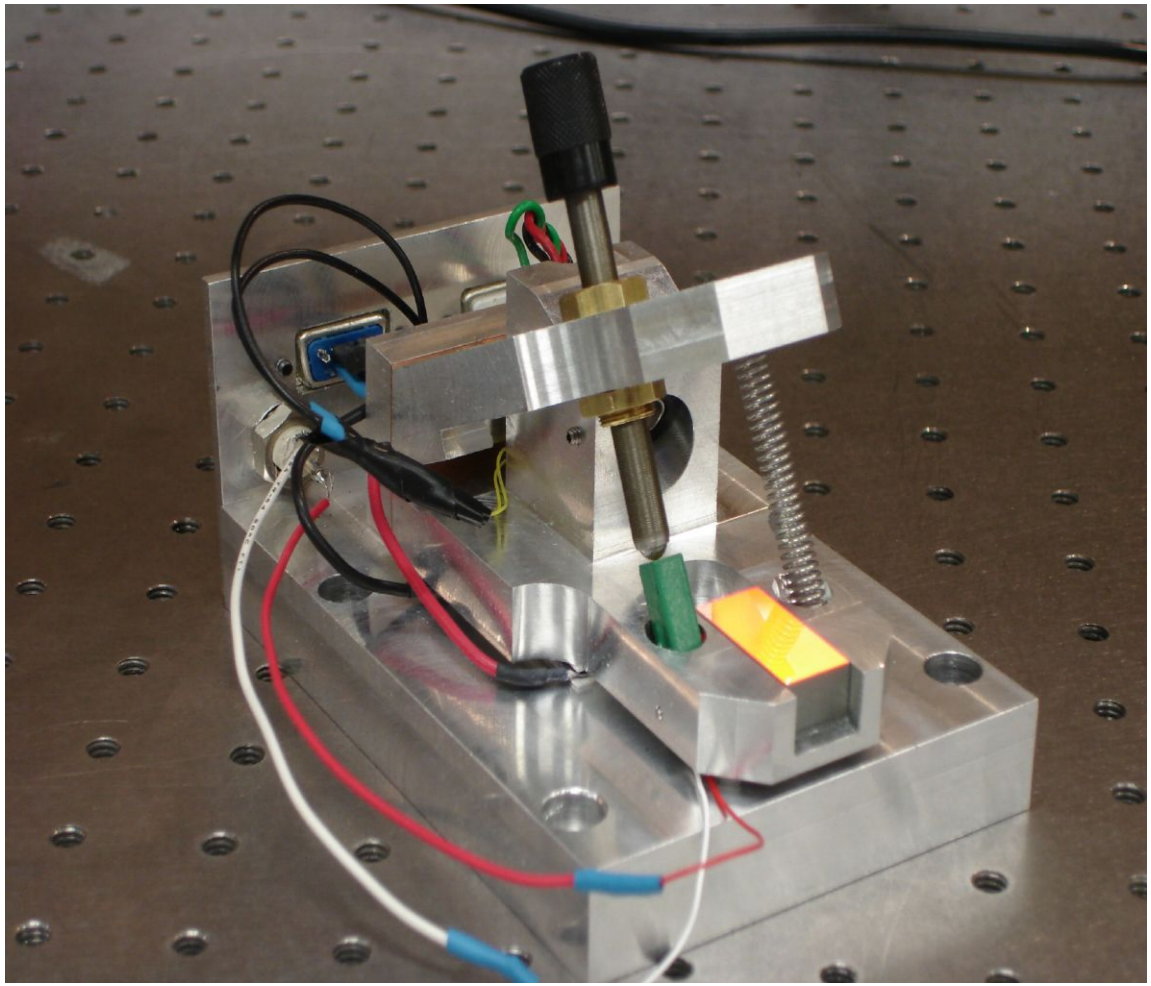
- Find out how natural variation of CO_2 and O_2 are related.
- Are they truly anti-correlated?
- Measure relationship in field.
- Use detection of both molecules to distinguish between natural variations and other sources.

O_2 Instrument



O_2 Instrument

- ECDL
- Narrow line width.
- Continuous tuning range of 80 GHz (~0.1 nm).
- Coarse Tuning of ~11nm



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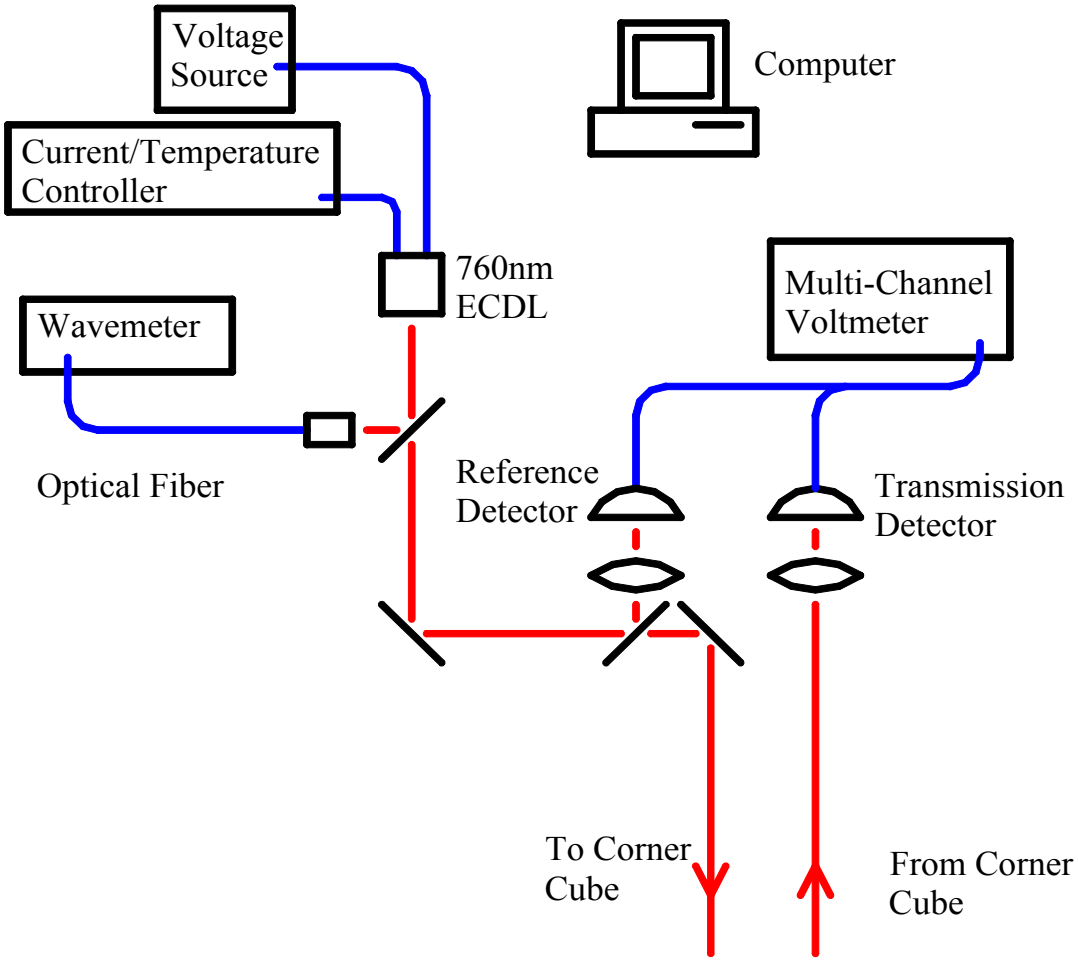

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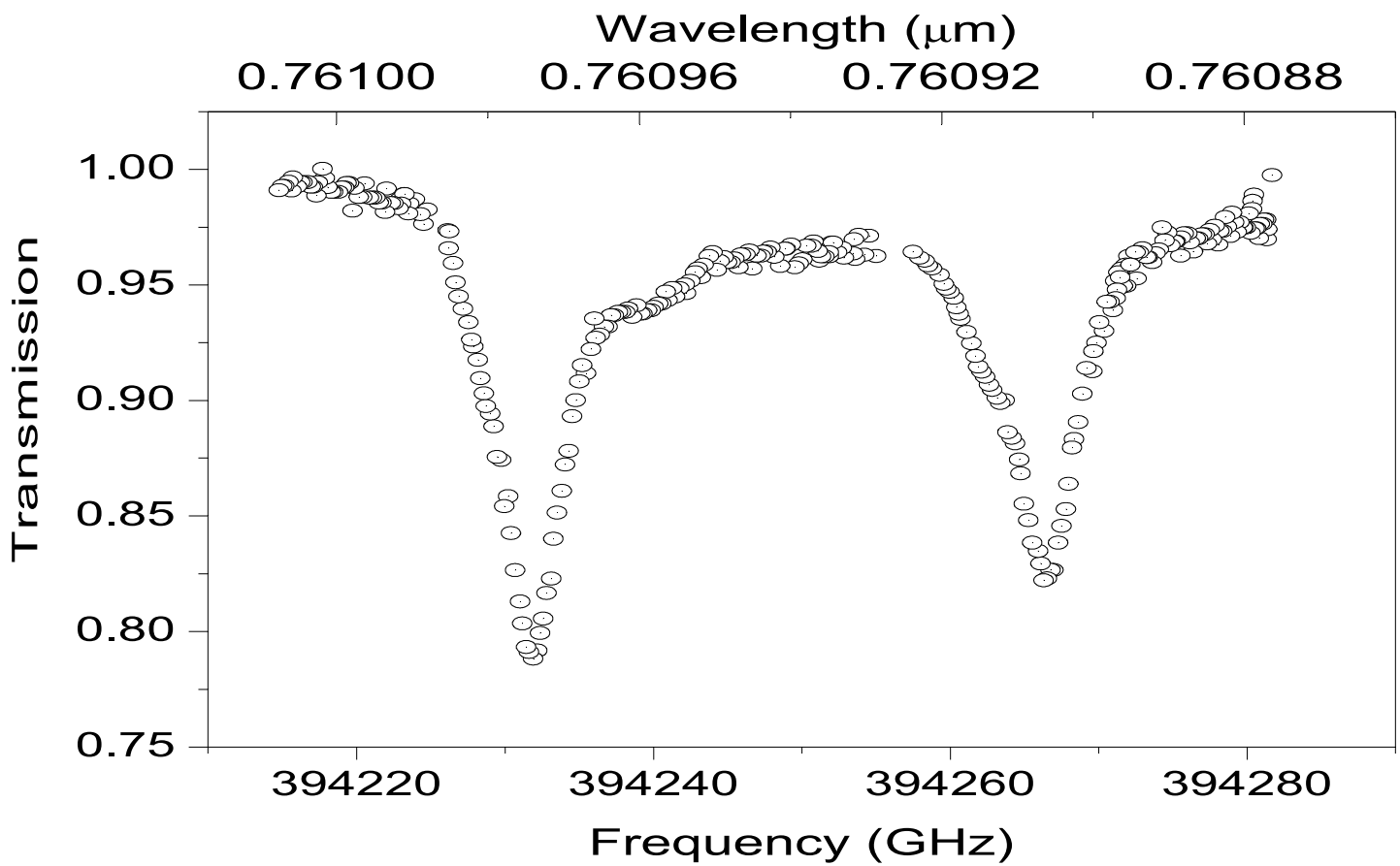

Results

- Demonstrated an optical technique and separate instruments for measurements of both CO_2 and O_2.
- Future work:
  - Finish calibrations
  - Field deployment
  - Fiber sensor based on these laser sources

Acknowledgments

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