# Development of high speed temperature imaging using hyperspectral tomography

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Introduction

- Temperature imaging system based on H_2O absorption tomography
- Capture quantitative, calibration free temperature images
- Minimal optical access requirements
- 50 kHz typical frame rate
- A 30-beam grid shown here yields 225 one-inch-square pixels in each image
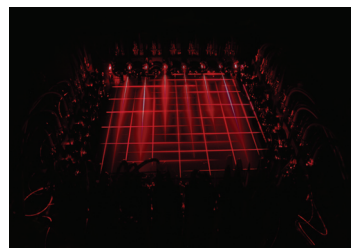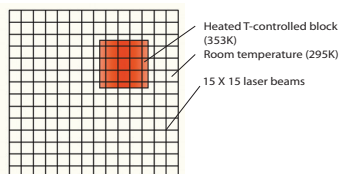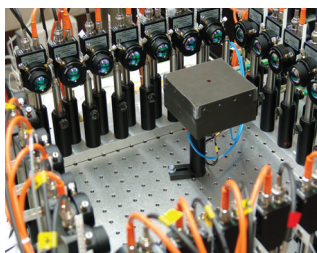
Beam forms a 15 X 15 2-D Cartesian grid

Propane-Air flame test
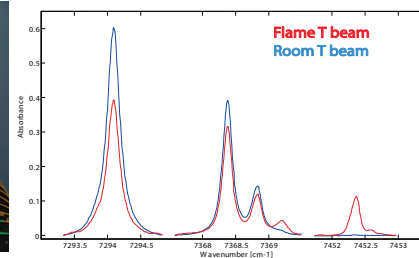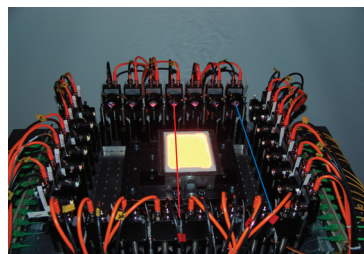
Single-shot absorbance spectra of 2 beams with different T

Temperature resolution study

Heated block setup:

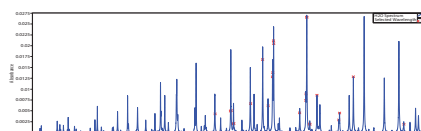Heated T-controlled block (353K)
Room temperature (295K)
15 X 15 laser beams

- Goal: Determine whether small temperature differences can be resolved, and if so, how small?
- Heated T-controlled blocks, 1"x1" up to 4"x4", could be arranged in the measurement domain.

Wavelength selection optimization:
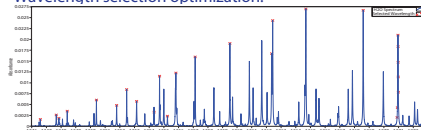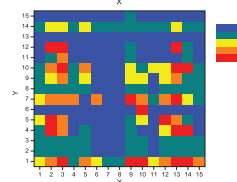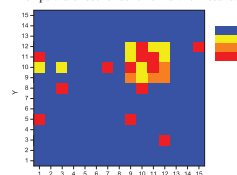

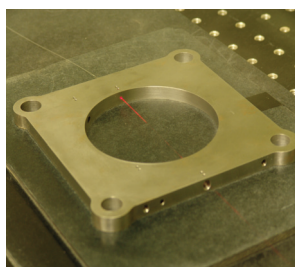- Choose 25 wavelengths which present higher temperature sensitivity

- Choose 25 wavelengths which have lower temperature sensitivity

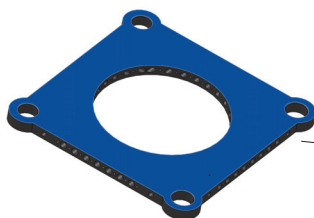Temperature reconstruction simulation results:

Initial conclusion: careful wavelength selection can yield improved results

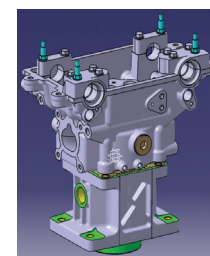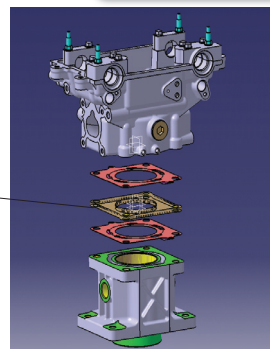## Fiber optic engine access

Single beam engine spacer ring setup

15 X 15 beams engine spacer ring model produces images with 225 pixels each 4.3 mm x 4.3 mm square

Future test: Engine 2-D T imaging

- 15 X 15 beams and 4.3 mm spatial resolution
- Goal: record continuous temperature video at sub crank-angle resolution over consecutive cycles in a HCCI engine.