Fabry-Perot for the Integrated Direct Detection Lidar: FIDDL

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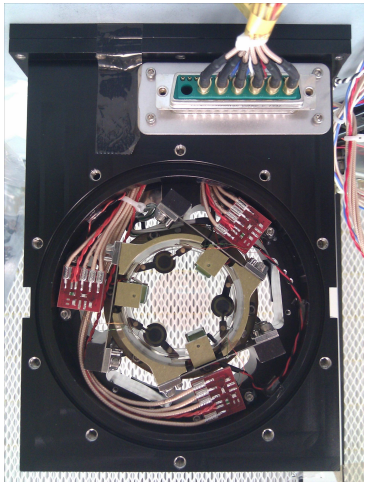
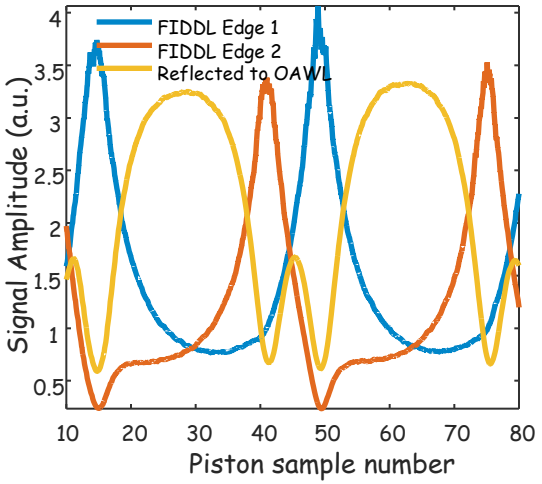
Objective

- Develop an etalon front end receiver (FIDDL) and combine it with the Optical Autocovariance Wind Lidar (OAWL) for an integrated direct detection (IDD) wind lidar
- Demonstrate the IDD hybrid system measuring winds from both molecular and aerosol returns using a single lidar
  - Hybrid system could significantly reduce the size and cost of a 3D-Winds mission (on the order of 20-30% based on aperture size) compared to the current hybrid 2-laser approach
  - Performance goal is < 1 m/s wind estimate precision for the etalon sub-system





Left: FIDDL etalon. Right: Measured FIDDL Edge1 and Edge2 transmissions, and Reflected (to OAWL) signals

Accomplishments

- Developed a new etalon in a dual-edge-through-a-single-etalon system using multiple angles and polarization multiplexing.
- Designed, implemented, and tested a new FPGA-based capacitive-bridge approach to etalon gap sensing and control. This demonstrated low open-loop noise measurements of gap changes with ~7-11 pm precision over ~100 dB dynamic range.
- Designed and built a kinematically mounted FIDDL optical bench and integrated it onto the OAWL bench for atmospheric testing using the OAWL transmitter laser, telescope receive path, and data acquisition system.
- Demonstrated the two-edge approach to wind measurements at 355 nm while simultaneously making measurements using the OAWL interferometer at both the 355 nm (reflected from FIDDL) and 532 nm (transmitted past FIDDL) wavelengths. OAWL aerosol wind measurement performance was unaffected by the combination.

Co-Is/Partners: Tom Delker, Ball Aerospace

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