

Instrumentation for Short and Long Range Clear Air Turbulence Measurements

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Objectives

Detection of clear air turbulence

- Short range (~200 m)
- Long range (> 2 km)

Technical Challenges

- Characterizing vertical flows (Kelvin-Helmholtz instabilities)
- Measuring horizontal temperature gradients

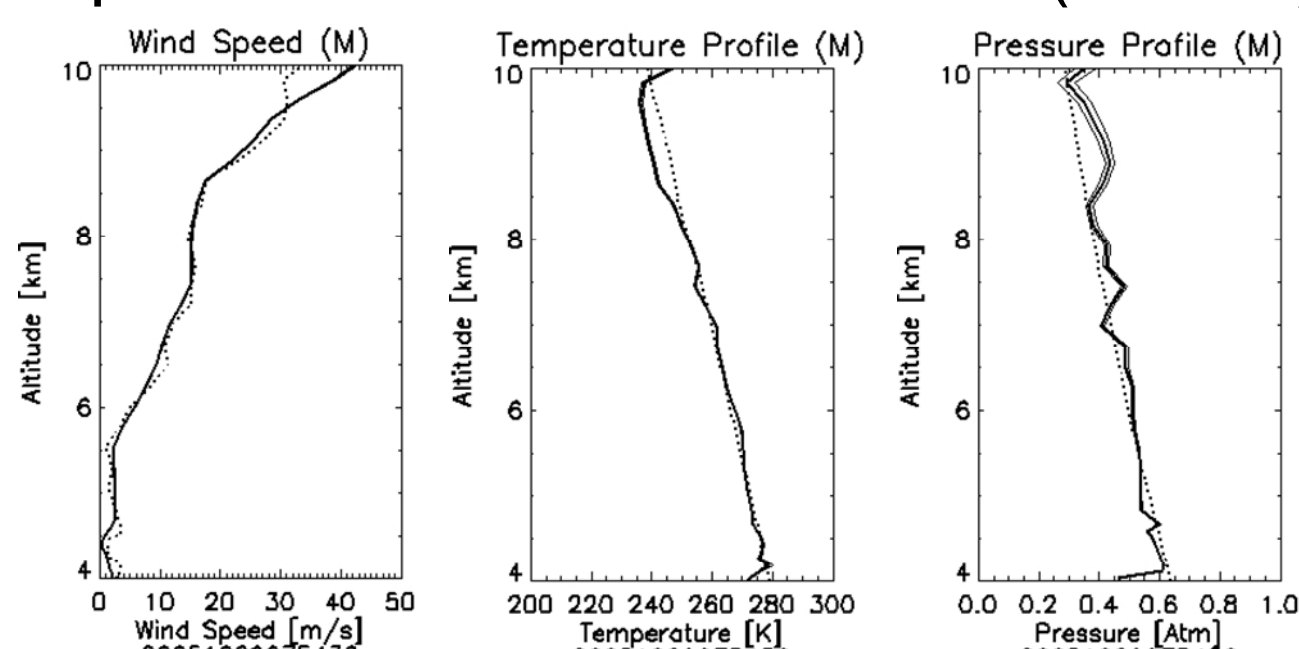
Technical Approach

- Direct detection airborne LIDAR
 - Long range measurements of density fluctuations
 - Short range measurements of velocity and density fluctuations

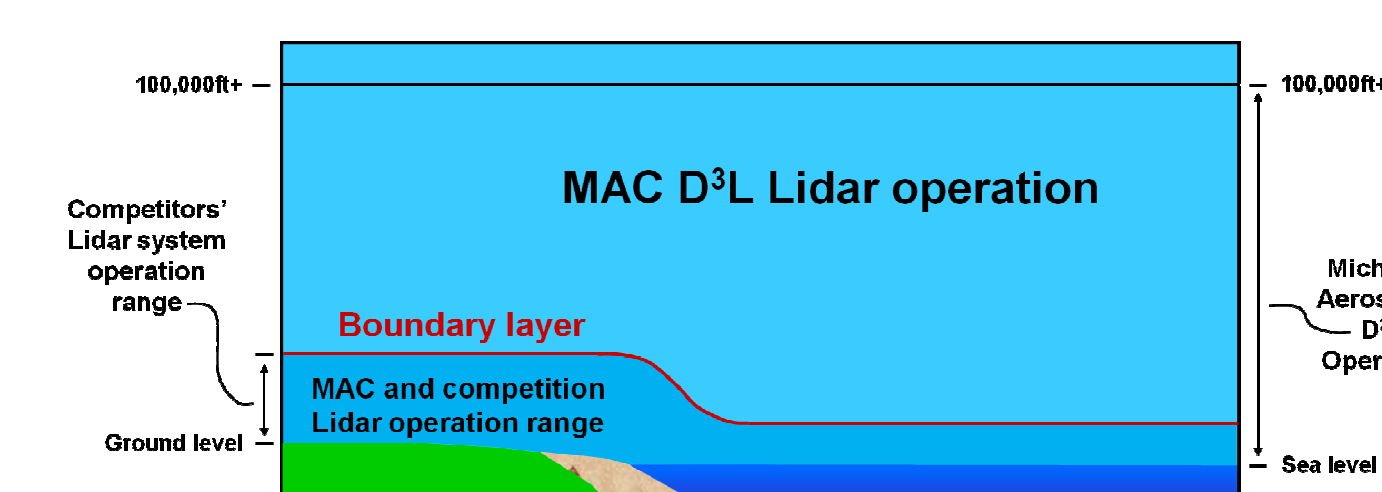
Program Status

Award is pending on the Phase II SBIR for long range measurement of clear air turbulence
Phase I SBIR program has just begun for short range measurements

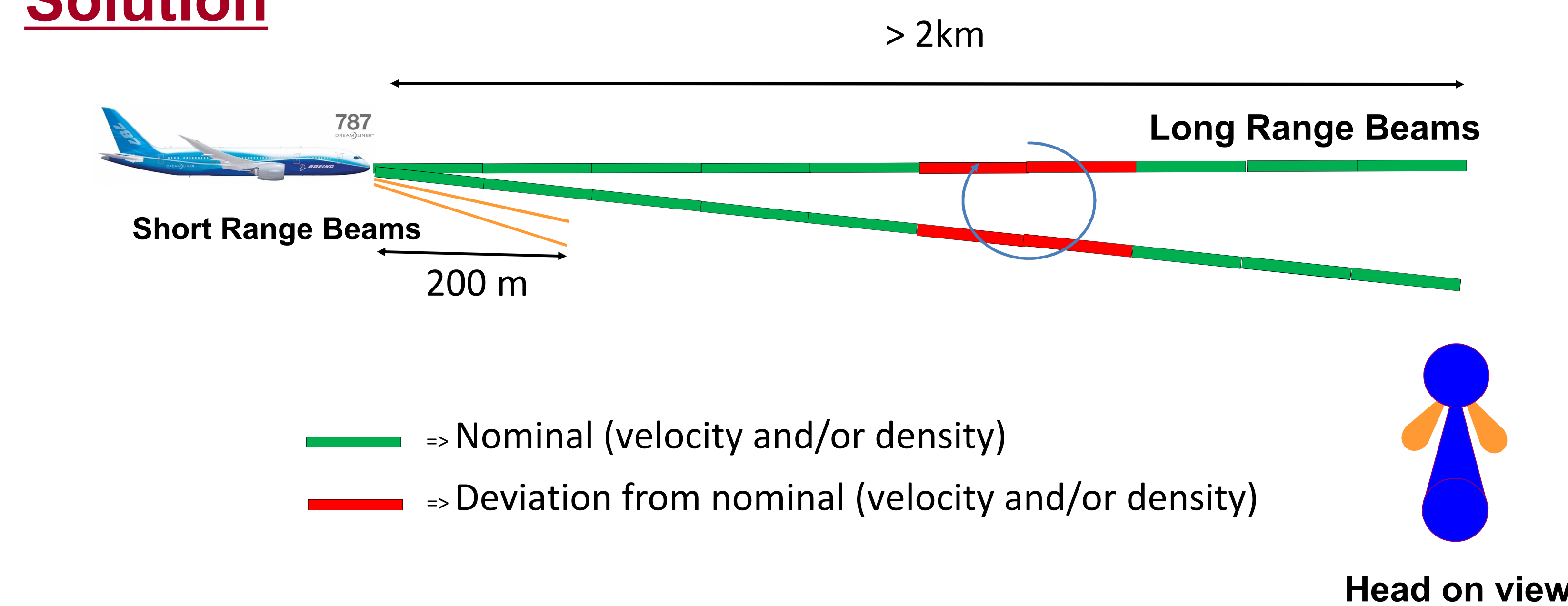
Three plots showing altitude profiles
Up to 10 km for GroundWinds (Hawaii)



Operational range for MAC's Direct Detection LIDAR



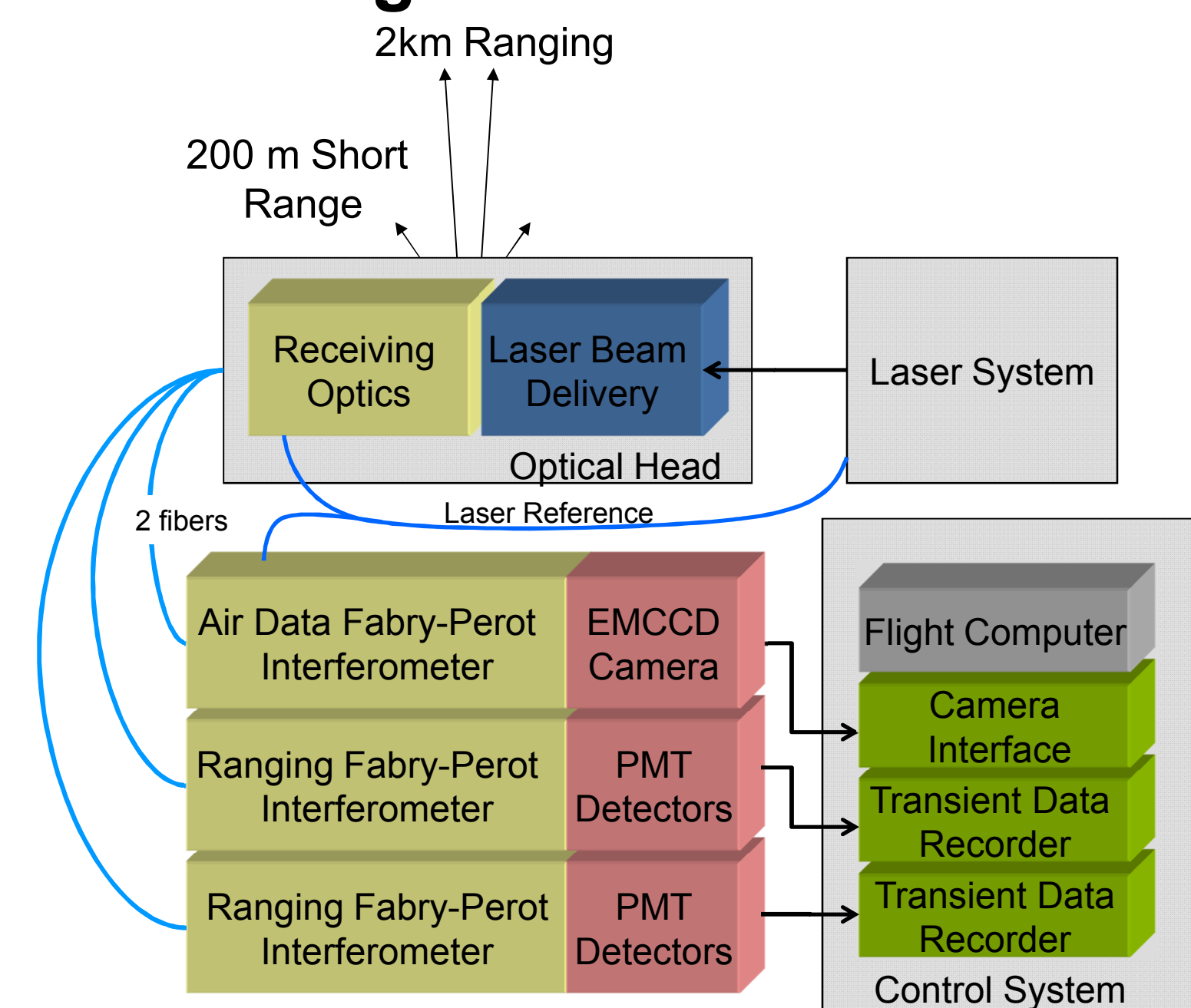
Solution



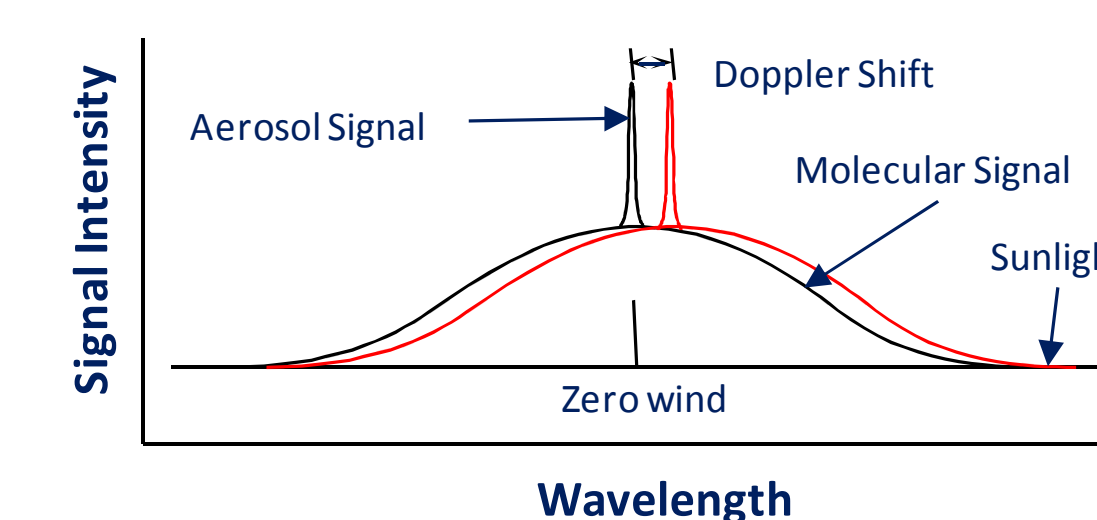
LIDAR specifications and concept

Components	Description (Preliminary)
Transmitter	
Laser	Laser 355nm @ 2W
Optical path	Free space
Receiver	
Collecting optics	Single collecting optics for both long range beams Second collecting optics for short range measurements
Optical path	Fiber coupled
Spectral analysis	Fabry-Perot etalon
Detector	Long range: Multi-Anode PMT Short range: EMCCD
Data acquisition	Transient data recorder

Block diagram of the LIDAR model



Principle of measurements



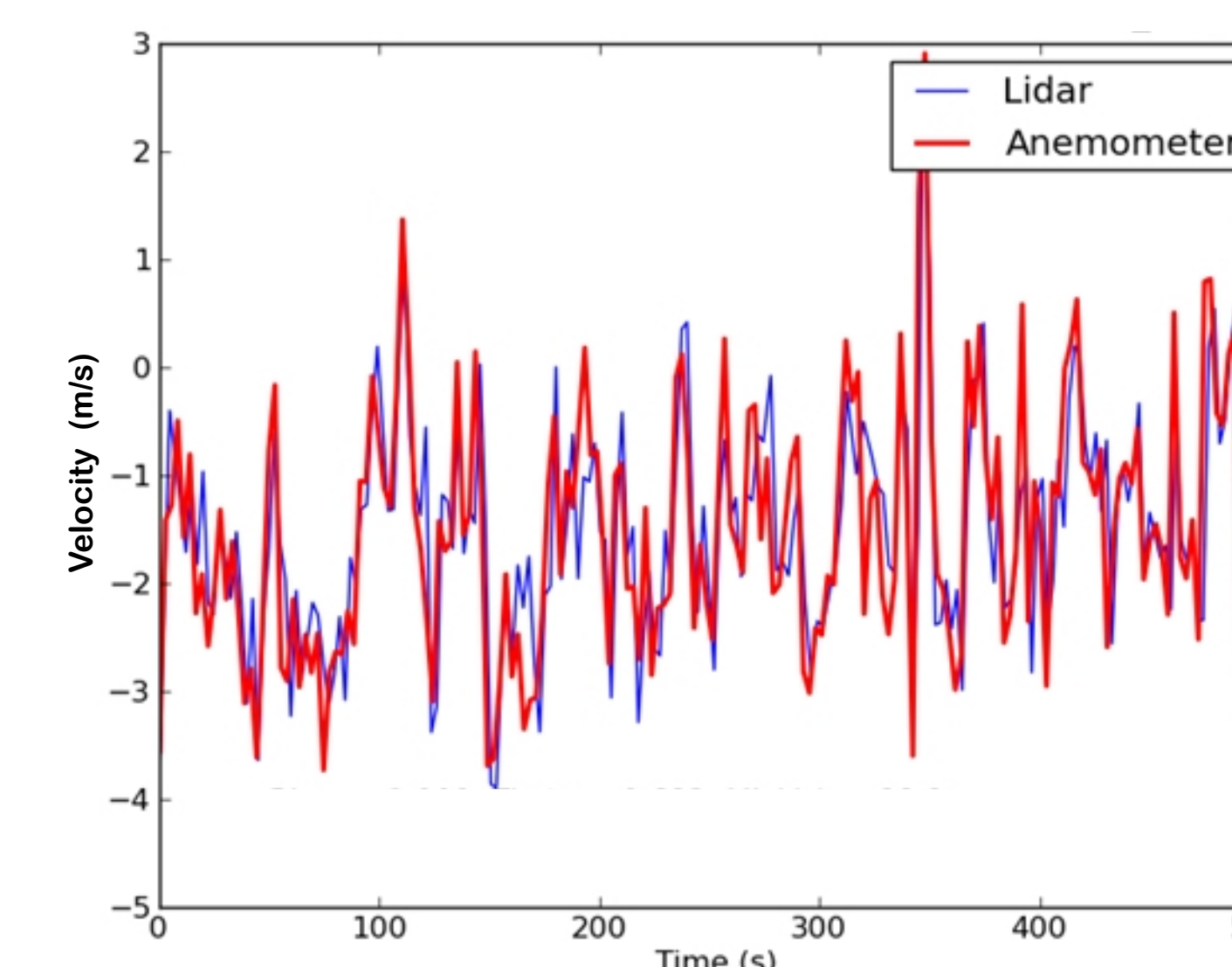
Analysis

- Modeling of the return signal using custom and OTS analysis tools
- Trade studies to optimize the instrument performance

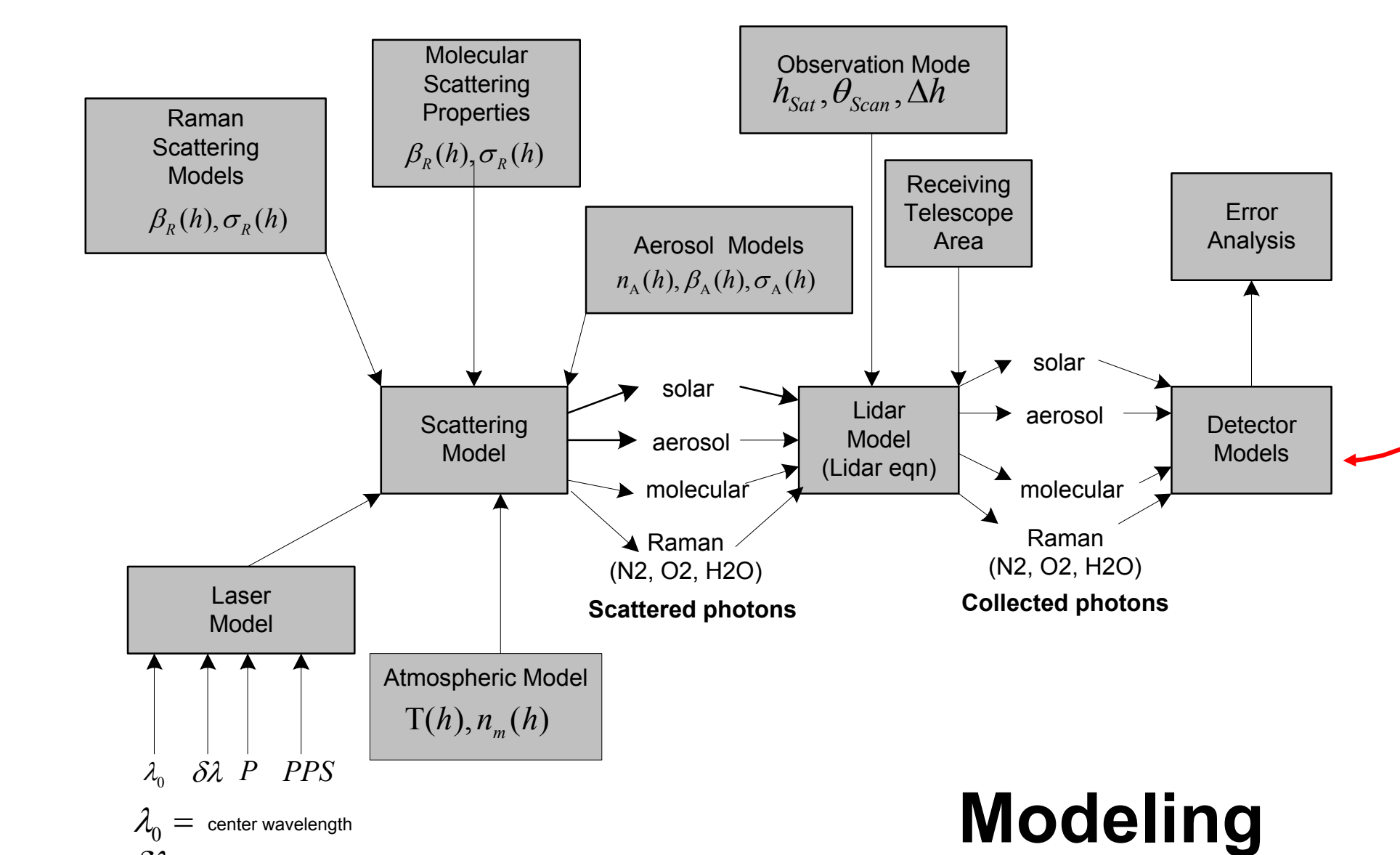
Results

- Modeling results for long range measurements
- LIDAR specifications
- Short range measurements

Short range measurements



Velocity and molecular count error modeled with 15 cm diameter receiver and 2 watt laser source (preliminary trade studies)



Modeling

