Development of Mobile Validation Lidar Facility at NASA/LaRC

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Validation Lidar Facility

Validation Lidar (VALIDAR) Facility:

- Well-instrumented 48 ft long Trailer
  - Hemispherical Scanner with 20 cm effective aperture
  - Elaborate Video System consisting of 2 sets of cameras, monitors, and recorders
  - Weather Station
  - GPS Receiver
- Powerful state-of-the-art Coherent Doppler Lidar
  - 75 mJ, 5Hz Diode-pumped, Partially Conductively-Cooled Transmitter
  - 25 cm SPARCLE Telescope
- Real-time data processor and display

Validation Lidar Facility

***VALIDAR* will be capable of validating:**

- New advanced technologies for space wind lidar instruments
- New signal processing algorithms
- Procedures for calibrating space-based wind lidar instruments and verifying their measurements
- Coherent lidar performance models and developing system calibration procedures
- Atmospheric models and studying the atmospheric effects on lidar wind measurements (boundary layer dynamics, tropospheric wind structures, clouds, turbulence and wind shears, etc.)
- Performance of other lidar techniques

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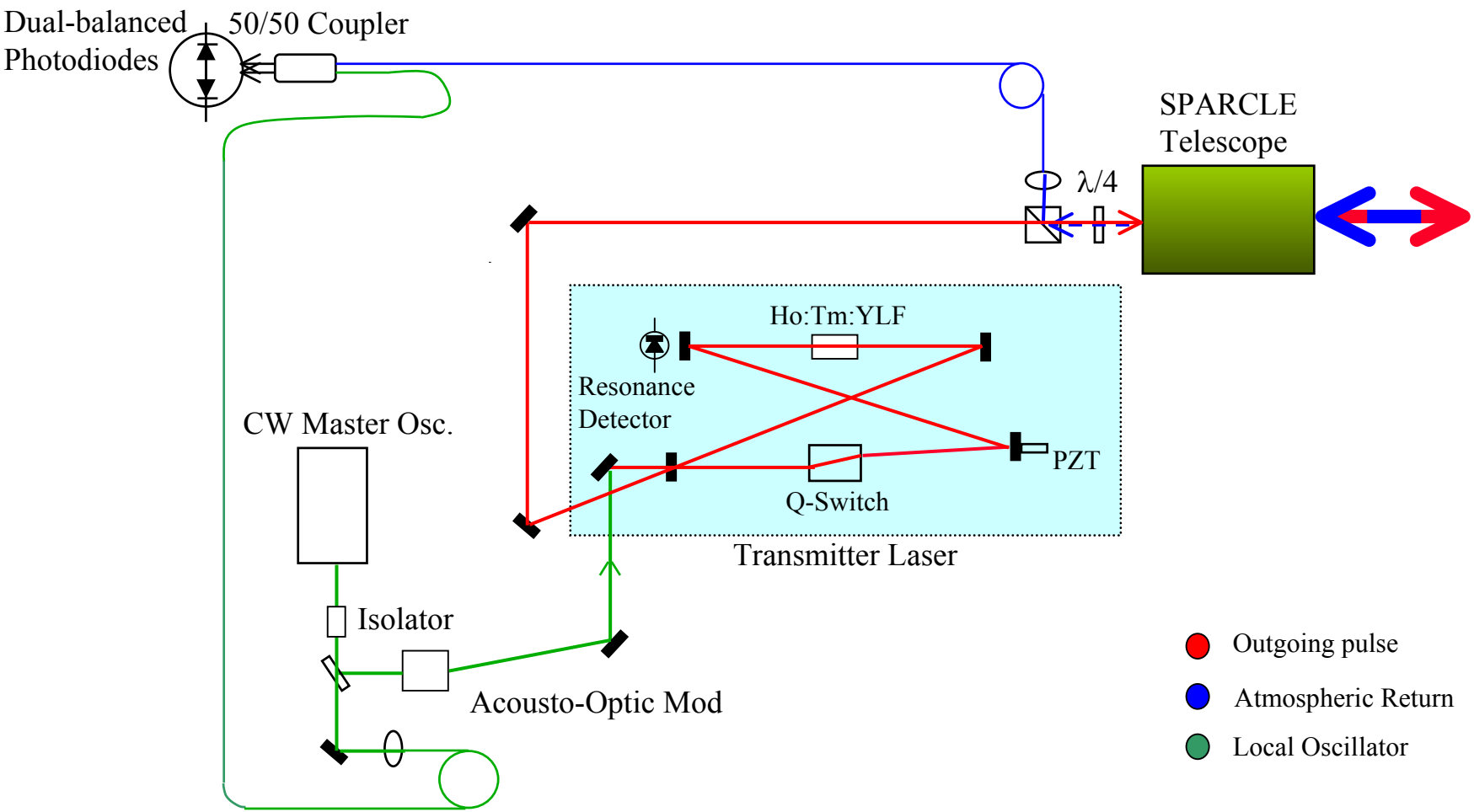
Lidar System



Validation Lidar Facility

VALIDAR is currently operational using:

- 5 mJ, 100 Hz diode-pumped Transceiver
- Existing data acquisition and processing hardware and software from Wake Vortex project

This setup is being utilized for defining the lidar optical layout and developing optical alignment procedures.

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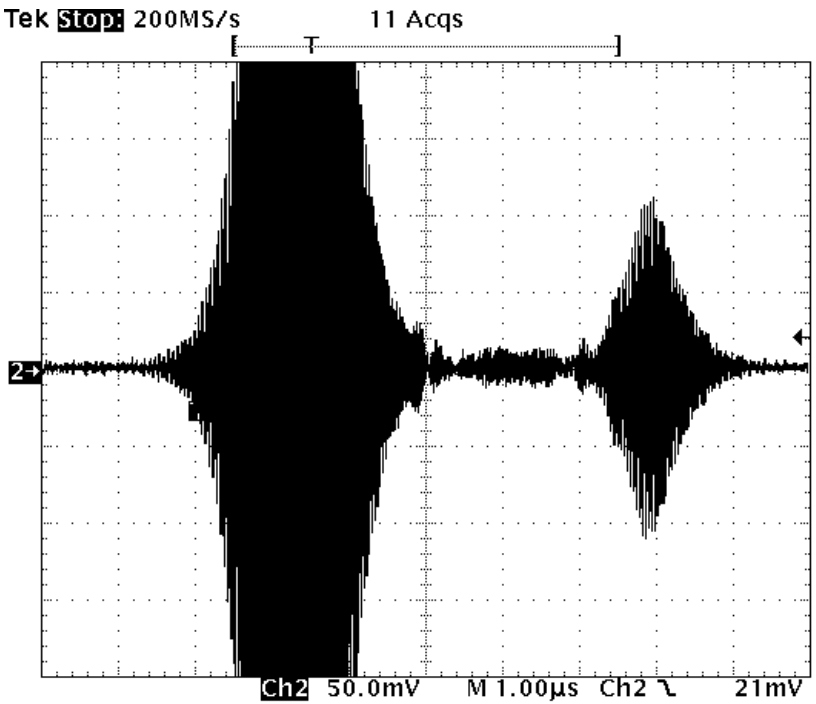
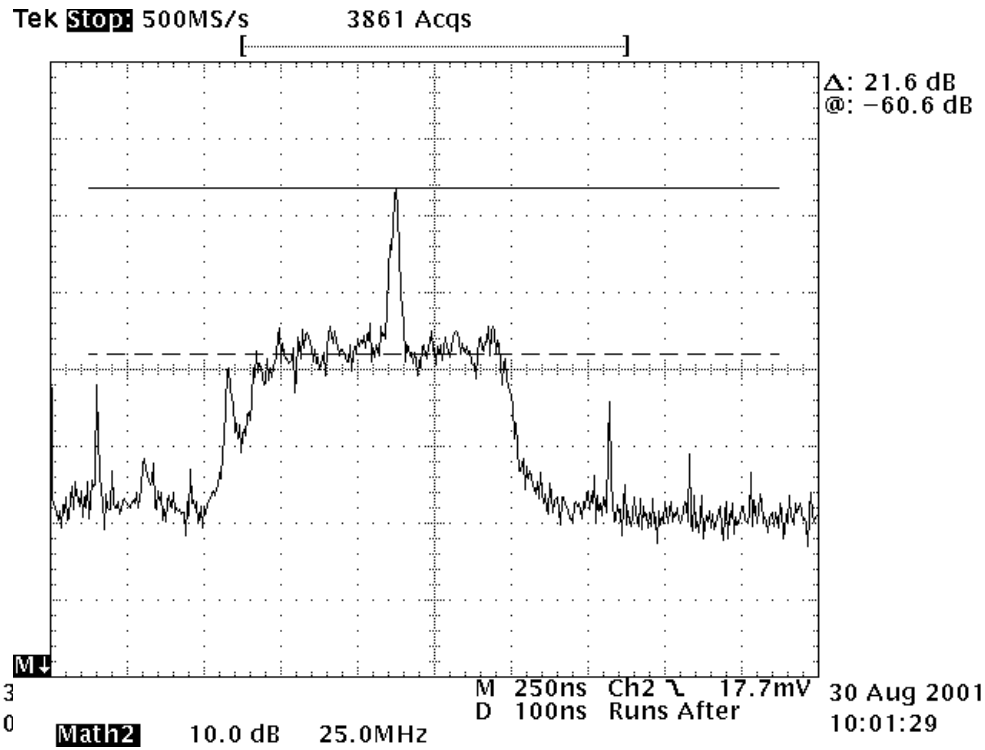
5 mJ, 100 Hz, 10 cm



Hard Target Return



Wind Measurement

(Range: 1.5 km, Averaging Time: 0.1 sec)

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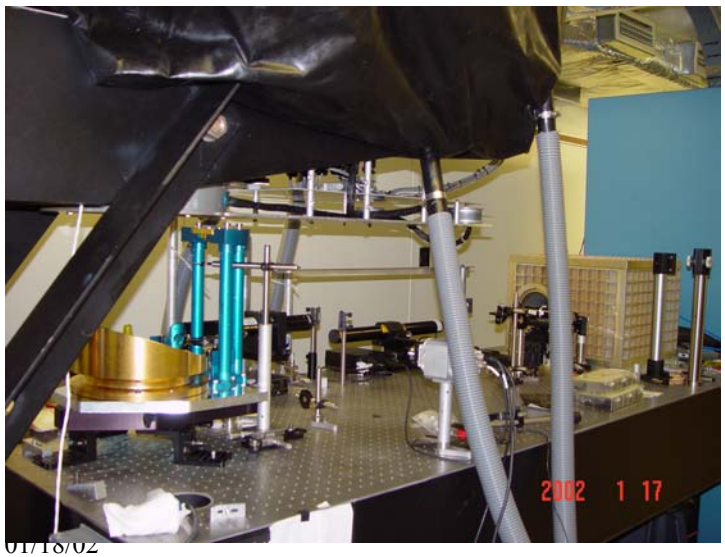
VALIDAR Trailer

Lidar System



Data Analysis & Visitors Rooms

Validation Lidar Facility

Specifications of Transmitter Laser Under-Development

- Pulse energy > 75 mJ
- Pulse repetition frequency > 5 Hz
- Wavelength = 2.05 μm
- Pulse width > 180 ns
- Spectrum = single frequency
- Beam quality < 1.3 x diffraction limit
- Partially Conductively-cooled Laser Head
  - Conductively-Cooled Diode Lasers and Water-Cooled Laser Rod

Conductively-Cooled Head Design

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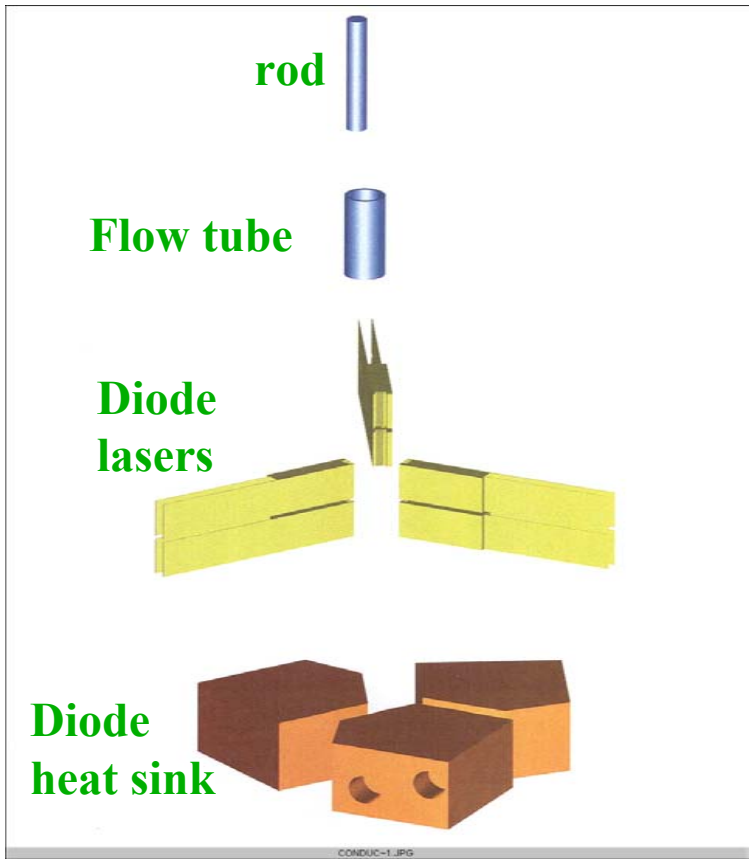
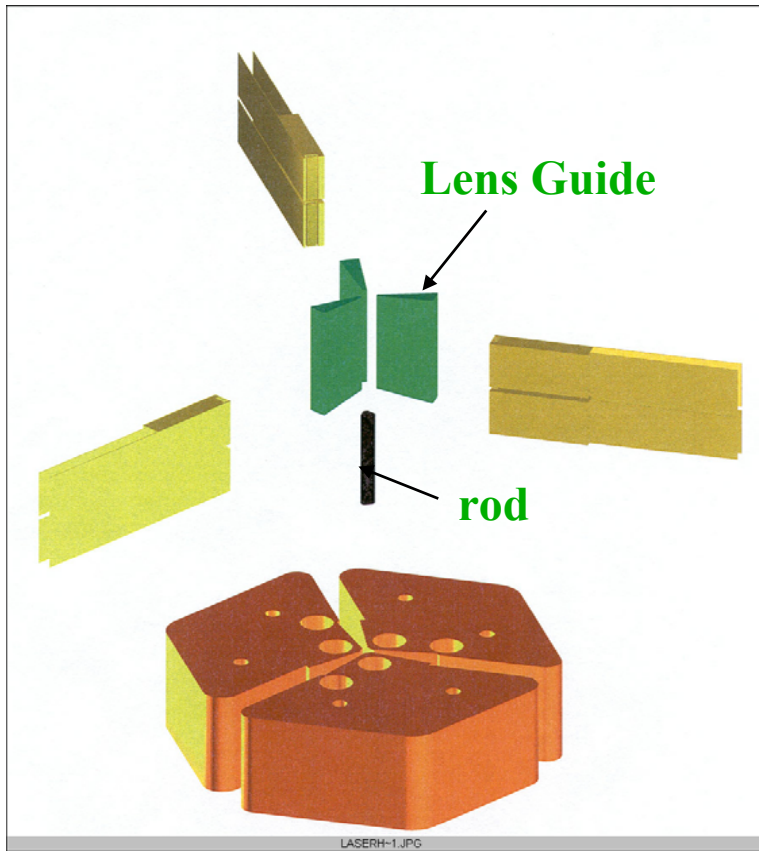
Partially Conductively-Cooled Head



Fully Conductively-Cooled Head



Laser rod is cooled with water

Partially Conductively-Cooled Head

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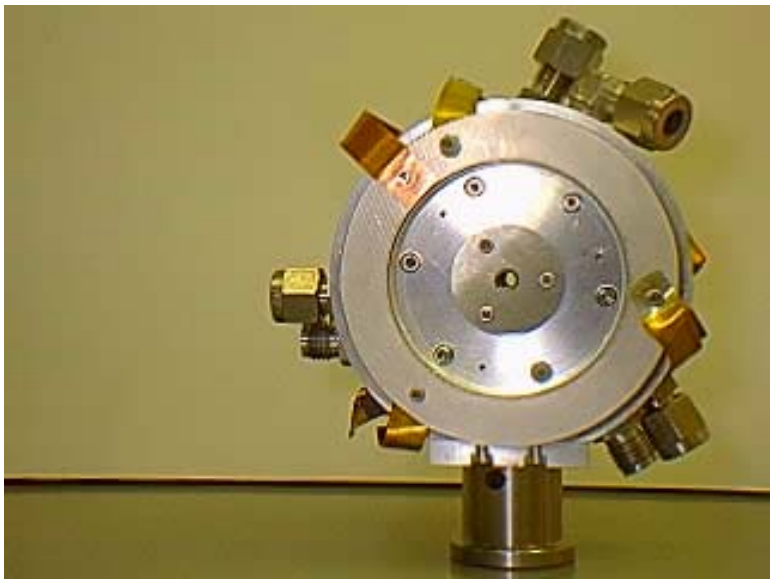

Validation Lidar Facility

Data Acquisition System Capabilities

- 12 Hz pulse repetition frequency (single or double pulse)
- 1 GSample/sec Sample Rate
- Max range (LOS) = 30 km
- Three processing modes:

  Mode 1
  - Wind velocity every 30 m; 1.95 m/sec velocity resolution
  - ~1000 512-pt FFTs (200 real pts plus zero padding)

  Mode 2:
  - Velocity resolution of 0.05 m/sec
  - ~12 16,384-pt FFTs (0.06 m/sec res.) or ~6 32,768-pt FFTs (0.03 m/sec res.)

  Mode 3:
  - TBD
- Data time-tagging and recording
- Real-time data display and scanner control

System Block Diagram

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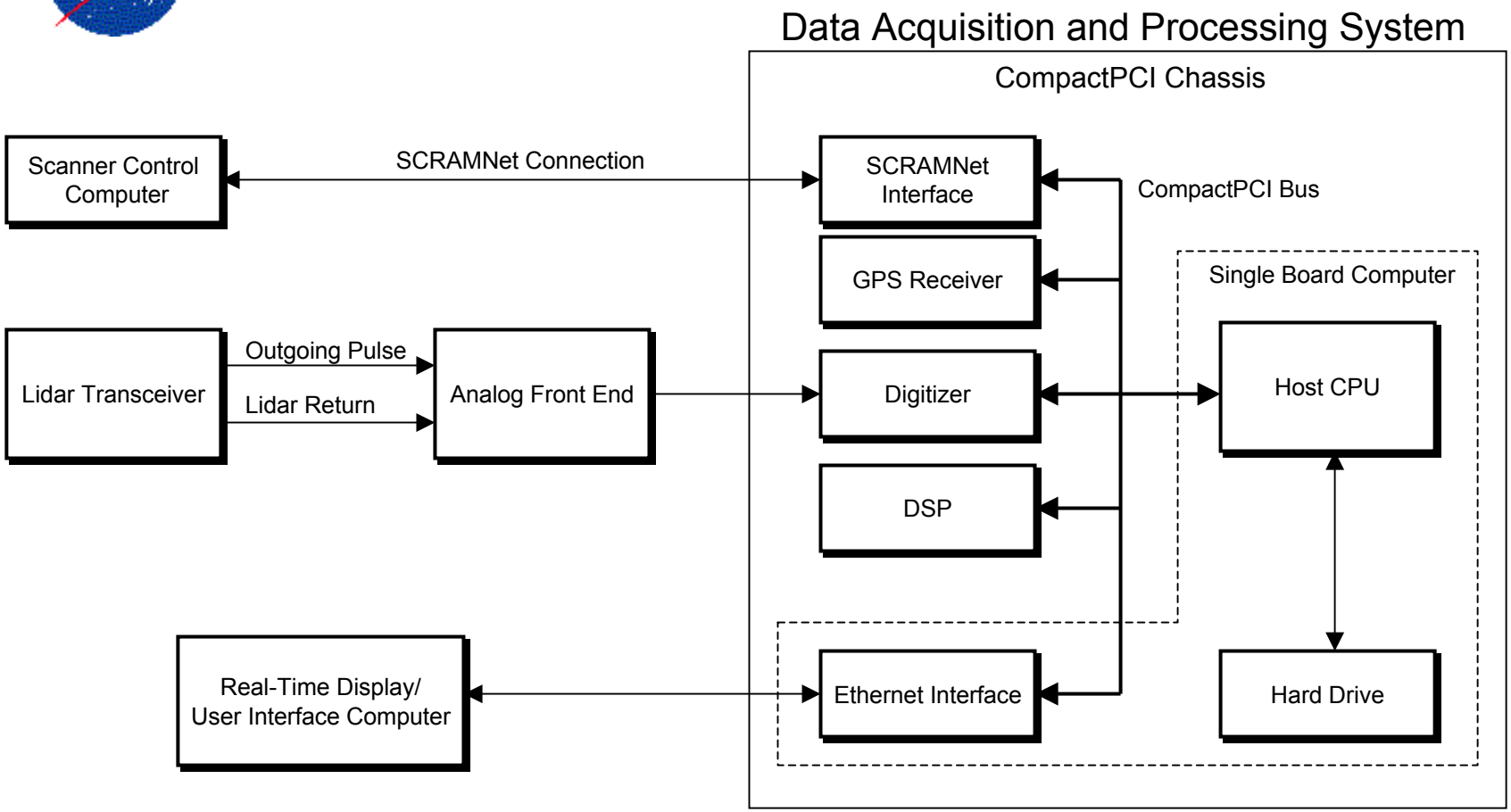

Signal Processing Data Flow

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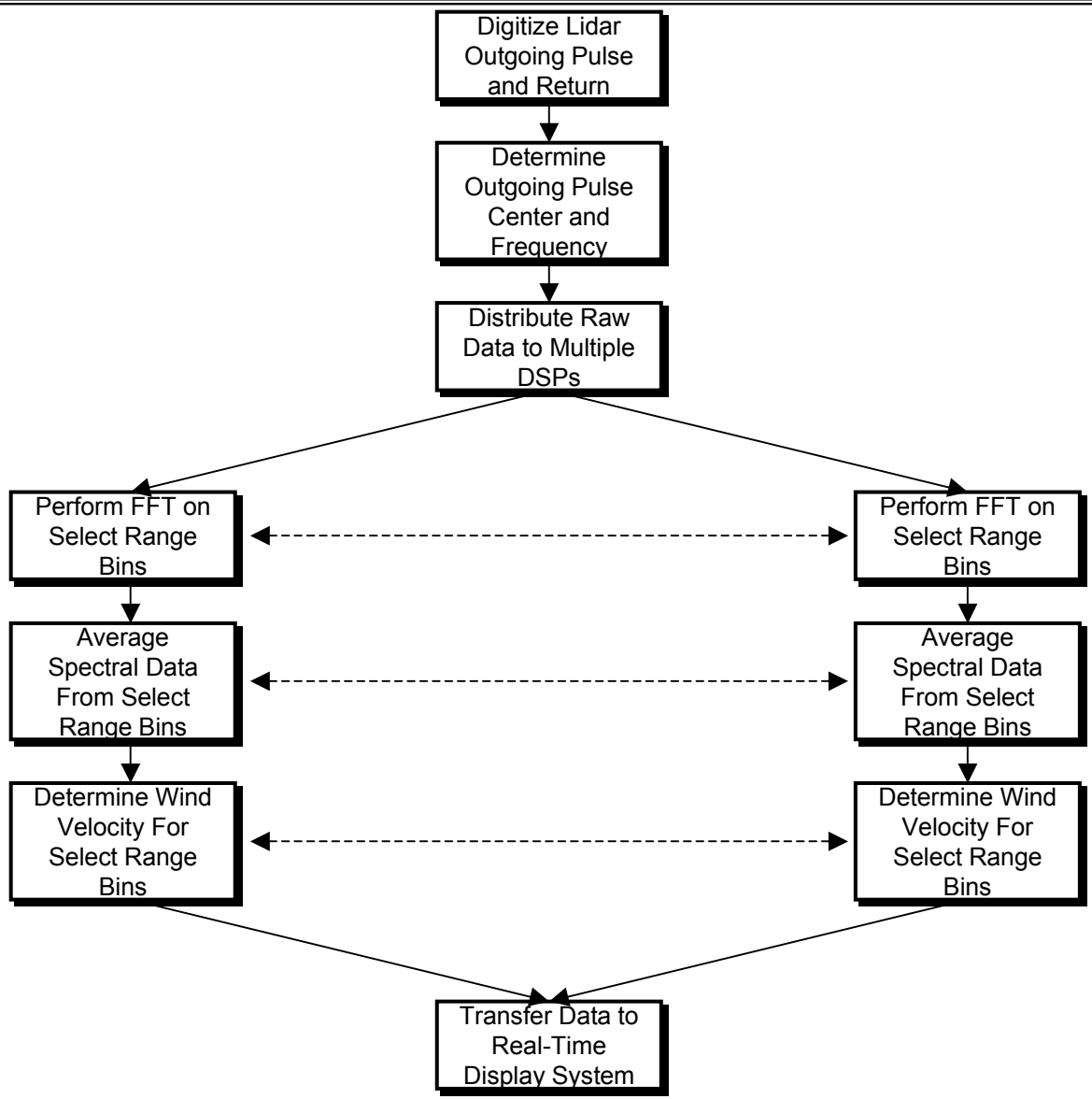

Validation Lidar Facility

Schedule

Lidar Receiver	June
75 mJ, 5Hz Transmitter Laser	July
Data Acquisition/Processor/Display	July
Lidar Integration	September
Open for Business	October

Acknowledgements

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