The Basics: Laser Radar - Lidar

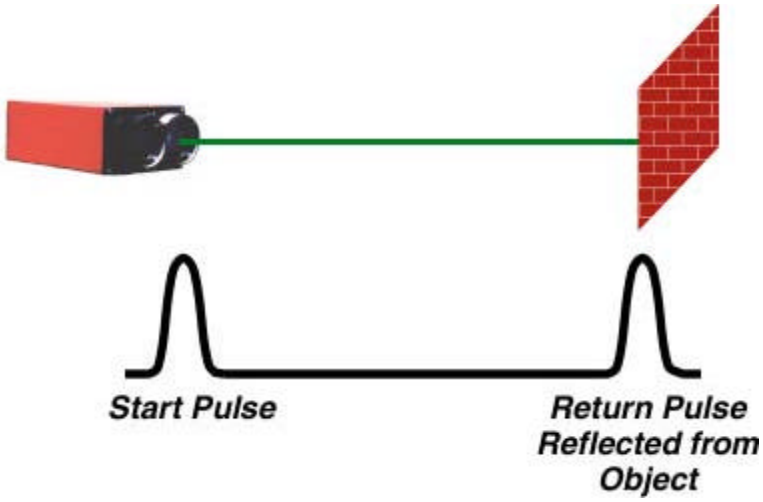
Laser radar, or lidar works a lot like ordinary radar, except that the RTV system (the Optech ALTM 2050 Model) sends out narrow pulses or beams of light rather than broad radio waves. 50,000 pulses per second to be exact. A receiver system times, counts and processes the returning light.

Laser + Receiver System = Lidar (Light Detection and Ranging)

Laser radar depends on knowing the speed of light, approximately 0.3 metres per nanosecond. Using that, we can calculate how far a returning light photon has traveled to and from an object:

Distance = (Speed of Light x Time of Flight) / 2

1. Laser generates an optical pulse.
2. Pulse is reflected off an object and returns to the system receiver.
3. High-speed counter measures the time of flight from the start pulse to the return pulse.
4. Time measurement is converted to a distance by using the formula above.



First/Last-Pulse Measurements

Our counting electronics can operate in two modes:

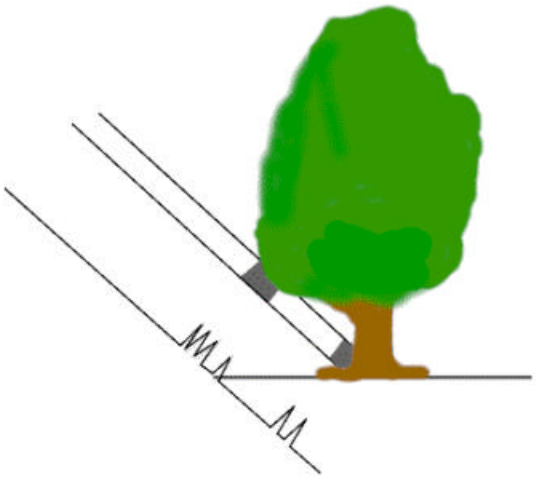
First-pulse

Measures the range to the first object encountered - in this illustration, the tree foliage.

Last-pulse

Measures the range to the last object - in this case, the ground.

By acquiring first- and last-pulse data simultaneously, RTV's laser can measure both tree-heights and the topography of the ground beneath in a single pass.



Intensity Measurements

Our data processing software can categorize detected laser pulses according to the reflectivity of the target surface. The output has the detail of high-resolution photographs, yet images can be taken at night and the data are already in digital form.

Highly reflective materials = Strong (intense) return signal

High Reflectivity:

- Light surfaces
- Grass
- Trees
- Water (wavy conditions)

Low Reflectivity:

- Dark surfaces
- Asphalt
- Coal, iron oxide
- Wet surfaces, mud
- Still water

Factors Affecting Reflectivity:

- Elevation
- Composition
- Density
- Orientation to the sensor

Are Measurements Affected By ...

Reflectivity of the Object

Not usually. Highly reflective objects may saturate some laser detectors, while the return signal from low-reflectivity objects may occasionally be too weak to register as valid.

Day or Night

No. Laser radar is an "active illumination" technique that, unlike photography, does not depend on ambient illumination. It works during the day or at night.

Sunlight and Reflections/Angle of Measurement

Sometimes. A strong sunlight reflection off a highly reflective target may "saturate" a receiver, producing an invalid or less accurate reading. However, laser measurements are not usually affected by other reflections. RTV's scanning laser instruments scan laser pulses within a preferred range of angles. Instruments are designed to operate in daylight.

Dust and Vapor

Yes. Laser measurements can be weakened by interacting with dust and vapor particles, which scatter the laser beam and the signal returning from the target. However, using last-pulse measurements can reduce or eliminate this interference.

Target's Angle of Repose

No. Laser measurements can be made to targets at any angle.

Background Noise and Radiation

The laser is not affected by background noise. Baseline radiation levels are determined to ensure that it does not interfere with measurements.

Temperature and Temperature Variations

No. Laser measurements are based on the speed of light and are unaffected by temperature variations.