Optech

measurement at the speed of light

Optech Overview

Optech is the undisputed market leader in LIDAR technology and related products.

- Canadian-owned / Privately held company (since 1974)
- 200 + person organization
- World-Renowned expertise and staff with over 30 years experience in Laser technology
- Lidar is the core technology employed in each of the systems manufactured by Optech
- For more information visit: www.optech.ca

Optech Overview

Optech is the pioneer and worldwide leading manufacturer of LIDAR systems offering a diversity of platforms catering to different industries and applications

Optech Business Units and Products

Terrestrial Survey

ALTM
Airborne Laser Terrain Mapper

Marine Survey

SHOALS 1000T
Bathymetry Hydrographic Survey

Space & Atmospheric

Space Operations
Atmospheric Monitor

Industrial Products

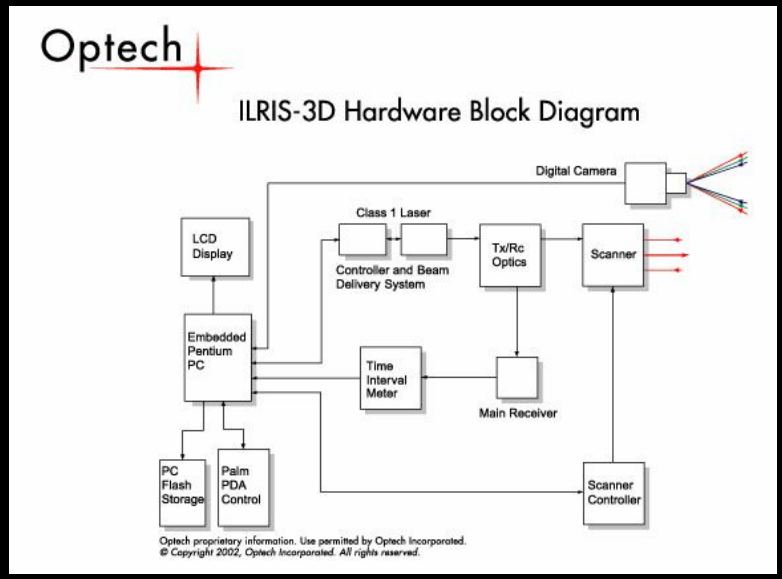
CMS: Cavity Monitor System

Laser Imaging

ILRIS
Intelligent Laser Ranging

Laser Scanning System Calibration: An Overview

1. Scanning System Sub-components:
   - Scanner Calibration
   - Timing Electronics Calibration
   - Waveform Calibration
   - Thermal Calibration
2. System Level Calibration Verification
   - Facilities and procedures

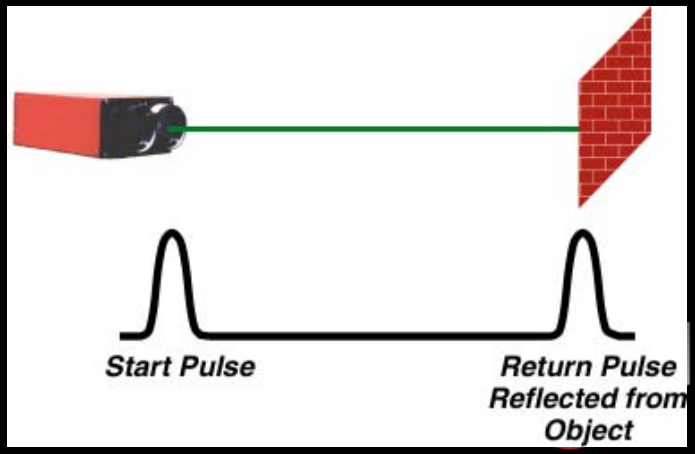


Lidar Overview

A sequence of events occur to define the operational theory behind Lidar

1. Laser generates and optical pulse (pulse of light)
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 using the constant speed of light formula

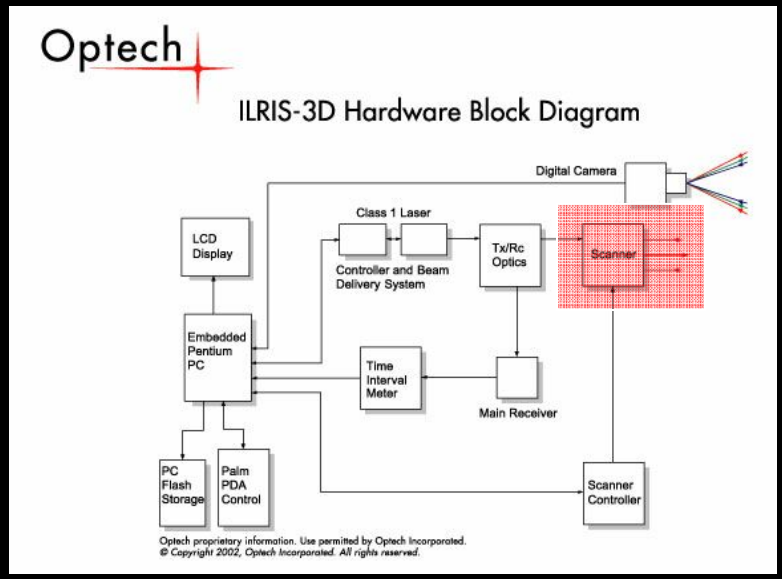
Range = (Speed of Light x Time of Flight) / 2



Scanner Calibration

Calibrating Scanner Mirrors

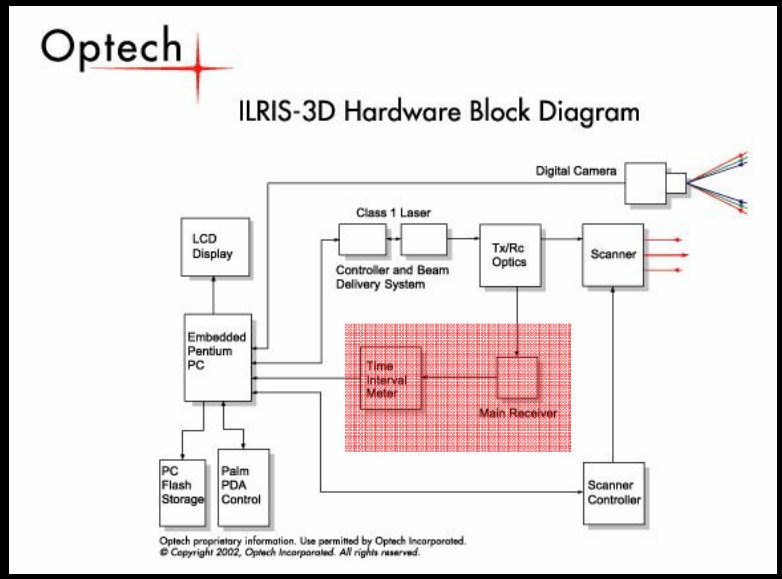
- ILRIS uses two oscillating scanner mirrors
- These mirrors oscillate at non linear speeds
- The encoder readout and the actual scanner position can have an offset
- The offset and the non-linearity are calibrated out of the system



Timing Electronics

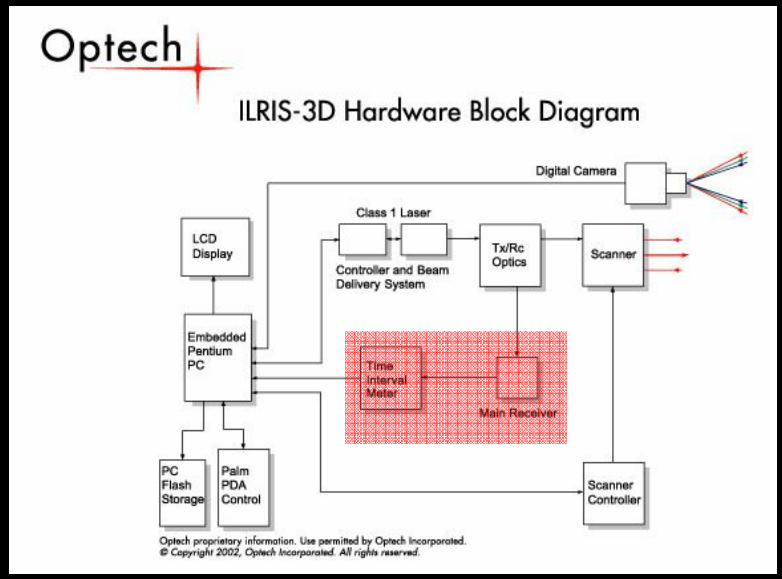
Calibrating the Range

- The timing electronics while accurate, can have a fixed offset between the actual distance and the calculated distance.
- This offset is calibrated out of the system using targets at known distances.

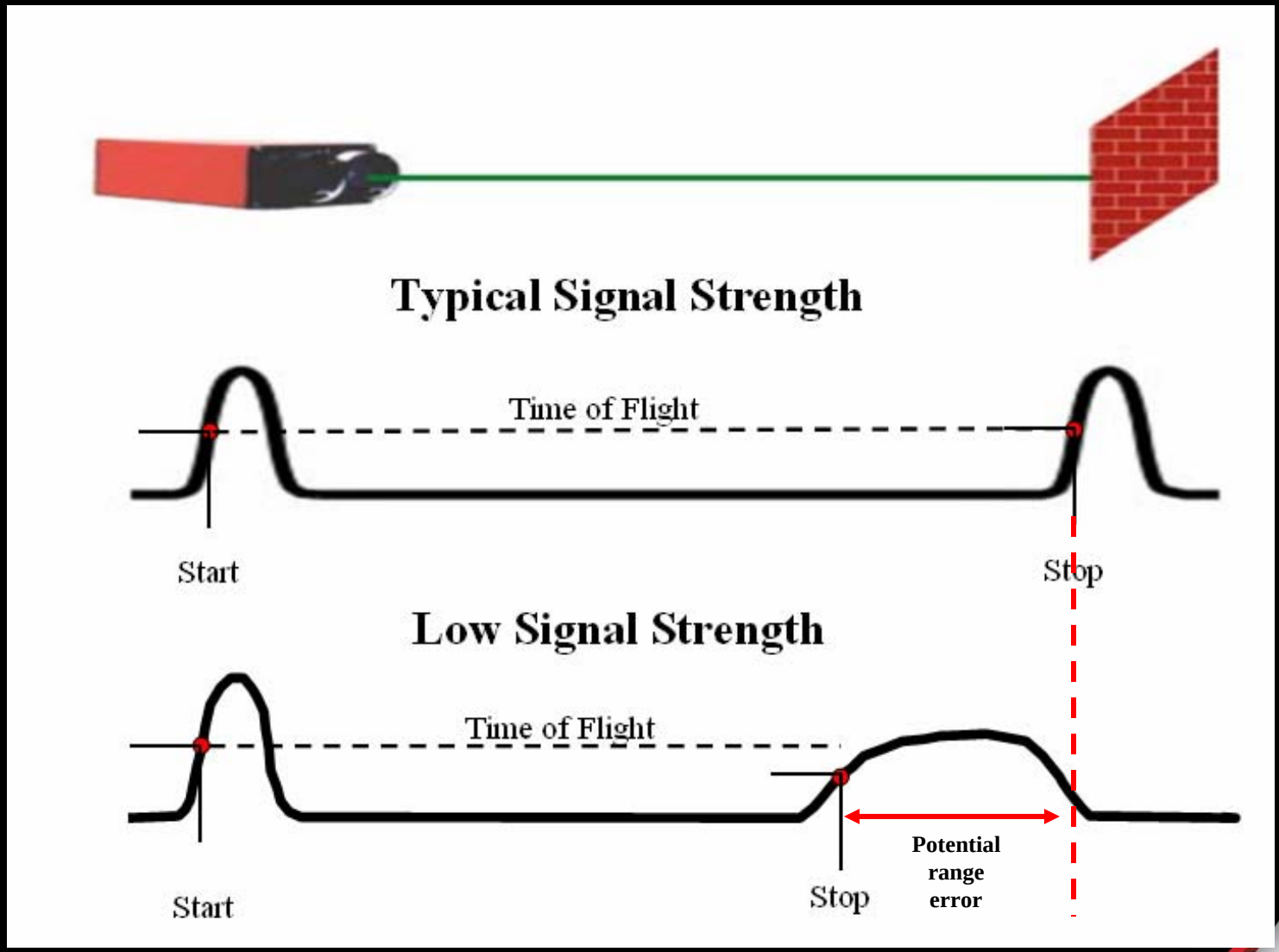


Waveform Calibration

- The electronic timing counter is started and stopped based on the detection of light
- The waveform of the pulse of light is never uniform
- The non-uniformity of the return signal shape must be calibrated to avoid ranging errors



Waveform Calibration



Thermal Calibration

- Varying thermal conditions will effect the performance of several system sub-components
- The effect on each of the sub-components must be characteristics by testing the system in varying conditions
- Includes varying temperature, humidity and air pressure

Publicly Available Verification Facilities

MINIMUM CONSTRAINT ADJUSTMENT ANALYSIS

BASELINE NAME: DOWNSVIEW, ONTARIO

* PASSES
X FAILS

VARIANCE FACTOR V.F.
GOODNESS-OF-FIT G.F.

Observation Period	Variance Factor	Degrees of Freedom	Statistical Tests		Inst. Constant mm [S.D.]	Calibration Constant mm [S.D.]	Calibration Scale ppm [S.D.]	Input Coordinates	Pier Movement mm [SD]		Average Scale Difference ppm [SD]
			V.F.	G.F.					At	Amount	
1991 July 31-Aug 2	1.499	34	*	*	+1.5 [0.1]	+1.5 [0.1] +1.5 [0.1]	-0.6 [0.2]	1987	3	-3.0 [0.1]	-3.1 [0.8]
1991	1.499	34	*	*	+1.5 [0.1]	+1.5 [0.1] +1.5 [0.1]	-0.6 [0.2]	1988	3	-2.8 [0.4]	-3.8 [5.7]
1991	1.499	34	*	*	+1.5 [0.1]	+1.5 [0.1] +1.5 [0.1]	-0.6 [0.2]	1989	3	-1.8 [0.3]	-5.4 [3.7]
1987,88,89, 91 COMBINED	2.099	178	X	*	+2.0 [0.1] +2.2 [0.1] +1.9 [0.1] +1.5 [0.1]		-1.1 [0.2] -0.3 [0.2] +0.8 [0.3] -0.6 [0.2]	Pier 3 identified as 3(88), 3(89), 3(91) in 1987/88, 1989, 1991 respectively.			

Summary of Publicly Available Facilities

ADVANTAGES

- Freely available and accessible to the public
- A good standard verification for quick equipment checks
- Provides a Government control over the area of some level of standard

DISADVANTAGES

- Always oriented to single point survey measurement devices
- Environments not always well controlled or physically maintained

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