LADAR vs. Laser Radar

API's 9D LADAR (LAser Distance and Ranging) incorporates a breakthrough technology that is set to revolutionize automated production measurements. The patent-pending 9D LADAR offers the fastest, most accurate interferometry-based non-contact measurement system, incorporating Optical Frequency Chirping Interferometry (OFCI) technology. API's OFCI technology uses 20 kHz speed fast laser chirping to generate a wide spectrum for optical interference. The interference signal detected, using the time series detection method yields 100x higher sensitivity than the phase-detection Laser Radar method.

LADAR Obsoletes Laser Radar

Dynamic 9D LADAR uses API's OFCI technology, developed over a 15-year period, with major sub-components designed for maximum performance and reliability. 9D LADAR provides micron-level resolution while eliminating issues associated with surface reflectivity, slow data acquisition speeds, limited accuracies, restrictive incident angles, and susceptibility to production environment noise. 9D LADAR outperforms traditional, off-line, large volume coordinate measuring machines (CMM) and near-line and in-line inspection solutions using conventional Laser Radar, optical laser-line and structured light scanning systems.

Laser Radar dimensional measurement systems have used phase-detection technologies, based upon frequency mixing whereby a chirped-frequency laser signal is sent to a target - the returned signal interacts with the outgoing signal creating the frequency mixing (Heterodyne) effect. Absolute ranging and system accuracy requires large sample averaging to obtain a reasonable accuracy, which effectively slows down the data rate, with both accuracy and performance highly dependent on surface reflectivity, incident angle, and background noise in production environments. When measuring metallic surfaces, the incident angle typically cannot be larger than 70-degrees.

Faster Automated Robotic Measurements

Non-contact Laser Radar technology has proven its ability to measure automotive parts including full 'Body-in-White', as a replacement for CMM measurements adjacent to production lines providing both external and internal measurements of vehicle body regions. 9D LADAR precision automated high-speed 'raster' scanning provides both surface geometry point cloud data collection as well as 'gap and flush' dimensional data. Laser Radar systems, although offering advantages over CMM measurements, remained too slow to pace production thereby providing an audit only measuring function. The enhanced speed and data collection rate of 9D LADAR dramatically increases the opportunity to pace production. Systems can be installed in-line or near-line. The new API 9D LADAR delivers the fastest ever laser measurement solution dramatically increasing measurement throughout and productivity for all automotive applications.

Robot Tracking and Calibration

Robot mounted Laser Radar measuring systems have traditionally been calibrated and robot positional accuracy compensated using 'tooling balls', limiting programmable calibrated robot poses, with the loss of measurement flexibility. API offers Dynamic Tracking of robot positioning using its 6DoF Radian Laser Tracker providing accurate real-time robot positioning and, unlimited calibrated robot poses. For applications where customers select tooling ball calibration the high dynamics of the 9D LADAR gimble, along with high scanning rate, ensures that non-productive sphere calibration times are dramatically reduced, optimizing measuring cycle times.

LADAR vs. Laser Radar Comparison

	API 9D LADAR SYSTEMS	CONVENTIONAL LASER RADAR SYSTEMS	IMPROVMENT
Core Technology	Optical Frequency Chirping Interferometry	Frequency Modulated Coherent Laser	✓
Data Rate	20,000 pts/sec	500 pts/sec - 1,000 pts/sec max	✓
Scanning Speed	0.2 sec/cm^2	1 sec/cm^2	✓
Raster Scanning	50 lines/sec – 0.1mm spacing	N/A	✓
Accuracy (σ)	Linear: 20 µm + 2 µm/m typical 3D: 25 µm/m + 6 µm/m (2σ)	Linear: 20 µm + 5 µm/m 3D: 20 µm + 14.5 µm/m	✓
Beam Spot Size	32 µm or smaller	Sub-mm	✓
Target Reflectivity	Insensitive	Sensitive	✓
Incident Angle	≤ 85-degree	≤ 45-degree	✓
Translucent	Measurement of translucent objects	Inability to measure translucent objects	✓
Control System	Integral	External	✓

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