

Sector Profile Scanner

Fast and accurate inspection of passing trains

The SPS inspects passing trains at full speed. A rotating polygon with eight flat mirrors deflects a laser beam, creating 800 profiles per second.

Shifted loads can cause accidents, particularly in tunnels and at stations. This can lead to the costly closure of railway lines. The Sector Profile Scanner (SPS) by Fraunhofer IPM identifies hazards such as rolling stock faults by measuring the geometry of passing trains.

3D image reveals irregularities

The stationary system measures the conformity of passing trains by acquiring high-resolution 3D point clouds. The 3D image is available immediately after the train passes and can be analyzed for geometric irregularities, such as loads that violate the clearance profile, open doors, deformed containers, overriding of buffers, and loose connections between wagons.

Four scanners for one profile

Laser scanners form the core of the SPS. Four scanners are needed to inspect an entire train. One pole on each side of the track carries two scanners at different heights. A rotating polygonal scanner with eight mirrors deflects the modulated laser beam onto the passing train and collects the returning light for analysis. The laser beam covers a scanning angle of 70 degrees. The measured distance values create a two-dimensional

profile of the corresponding train section. The four profiles are then processed into a combined profile of the entire train. As the train moves, thousands of such profiles are measured, providing a three-dimensional image of the inspected train. The distance between profiles depends on the train's speed and the scanning rate. A high scanning rate is crucial for achieving a good profile density for fast-moving trains.

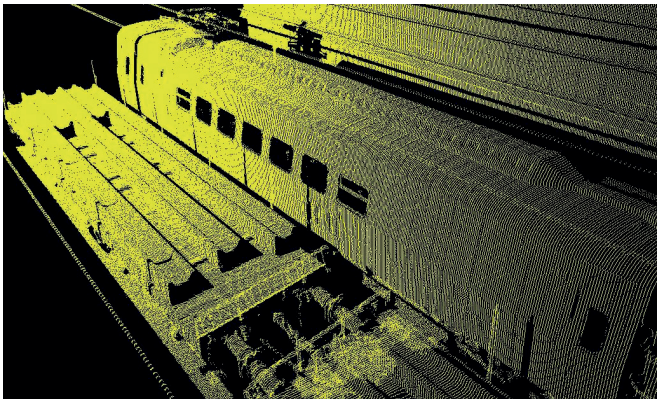
Up to 2 million data points per second

The laser scanner can measure up to two million data points per second. Based on this extraordinarily high measurement rate and the polygon mirror design, data capture is flexible according to customers' need.

In addition to the standard version, Fraunhofer IPM offers a High Angular Resolution (HAR) setup that provides 1,800 data points per profile at 800 profiles per second, addressing the requirements of freight trains

Railroad measurement systems by Fraunhofer IPM

Fraunhofer IPM develops optical measurement systems for monitoring and mapping rail infrastructure. Experts in optics, system designers, and electrical and software engineers work together to supply turnkey solutions for the special requirements of infrastructure operators, planners, and providers of surveying services. The robust measurement systems are used around the world and are characterized by their speed, precision, and reliability.



Left: The 3D image is available immediately after the train has passed and can be analyzed for geometrical irregularities.

Right: Four scanners measure the geometry of passing trains.



and moderate-speed passenger lines. Furthermore, the High Profile Density (HPD) setup is designed for use on high-speed lines. It features 900 data points per profile at 3,200 profiles per second, which results in a density of 32 profiles per meter at 360 km/h.

The optical power of the infrared laser is optimized for a measurement range of about 10 meters, allowing inspection of rolling stock even on double tracks while fully maintaining eye safety. By exploiting the advantages of the phase-shift technique, a typical accuracy of 5 mm is achieved over the full measurement range. The scanners calibrate themselves before each profile measurement. This ensures stable results over extended periods, practically independent of ambient temperature.

Reliable operation

The SPS's design guarantees almost maintenance-free operation. The hermetic housing of the system keeps dust and humidity away from the optics and electronics. A baffle reduces stray light and pollution on the outside of the measuring window. Once the mirror stops rotating, the laser turns off, ensuring eye-safe operation at all times. The SPS is eye-safe according to IEC 60825.

Fast, accurate, and robust

With its combination of high measurement speed, accurate results, and robust design, the SPS is ideally suited for the challenging task of inspecting passing trains at full speed. This holds true even under difficult lighting and environmental conditions.

Technical specifications

Scanning angle	70°
Distance range	1.3 – 10 m
Distance uncertainty	10 mm (1 σ , 10 m, R = 50 %)
Point density	900 (one point every 12 mm at 10 m distance)
Measurement rate	1 million measurements per s (standard) 2 million measurements per s (HAR, HPD)
Profile rate	800 per s (standard) 3,200 per s (HPD)
Profile density at 100 km/h	35 mm (standard) 8.7 mm (HPD)
Housing	IP 67
Eye safety classification	Laser class 1
Operating temperature	–20 to 55 °C

All specifications and features are subject to modification without notice.

**CLASS 1
LASER PRODUCT**

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