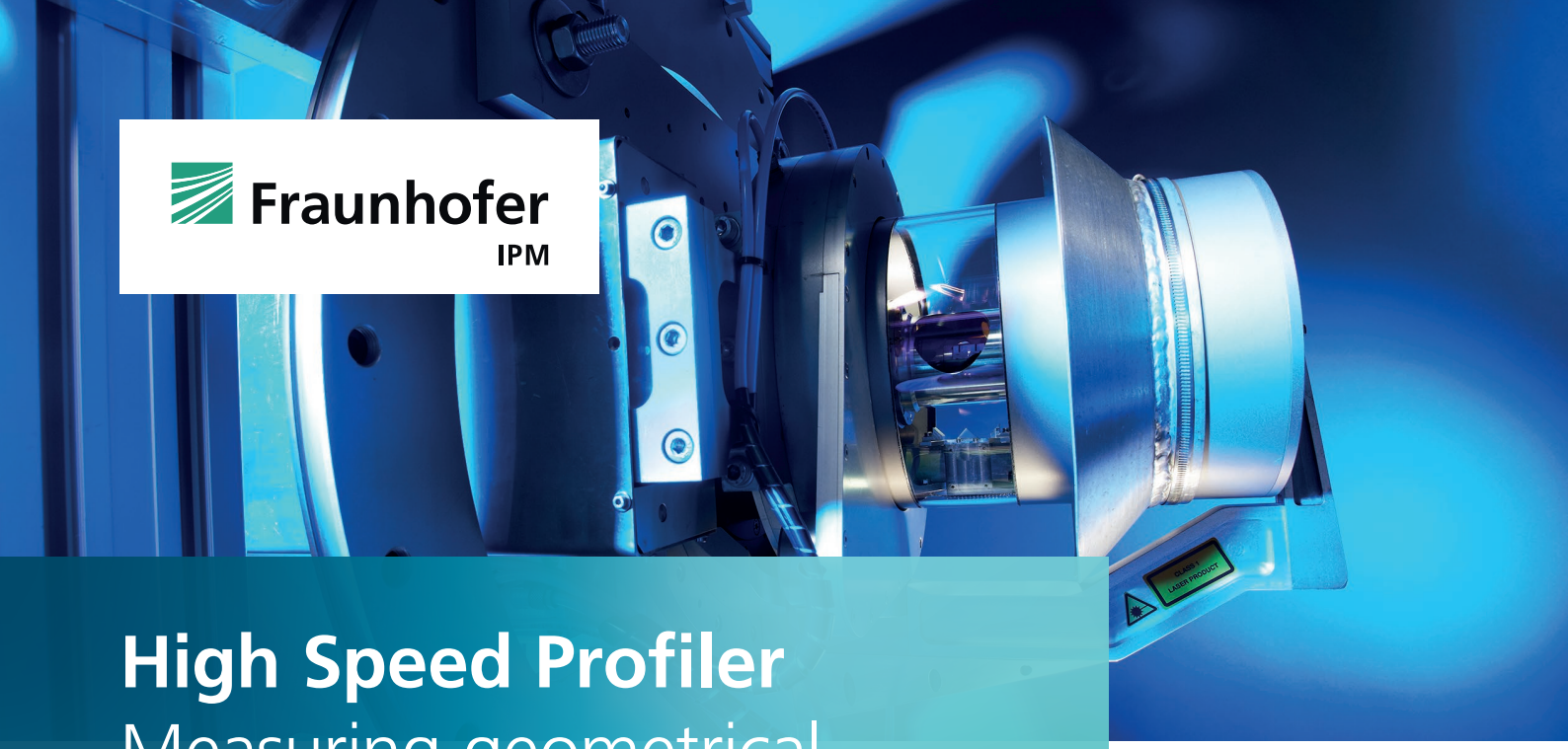
Fraunhofer IPM



High Speed Profiler

Measuring geometrical changes of structure gauge

The HSP laser scanner can be mounted on mobile platforms. The sensor head comprises two laser modules for highly precise geometrical measurements.

Precise, fast, robust and non-contact

Shifting ballast beds or objects infringing the clearance profile pose hazards for rail vehicles. Railroad operators have to carry out inspections regularly to avoid rail vehicles being obstructed or being put at risk. The High Speed Profiler HSP by Fraunhofer IPM records clearance profiles fast and non-tactile with two laser modules per sensor head.

Infrastructure data in real time

The HSP records tunnel surfaces and identifies objects infringing the gauge profile. The optical system provides three-dimensional data in real time using the track's center line as reference. Maintenance teams receive very detailed information on the infrastructure.

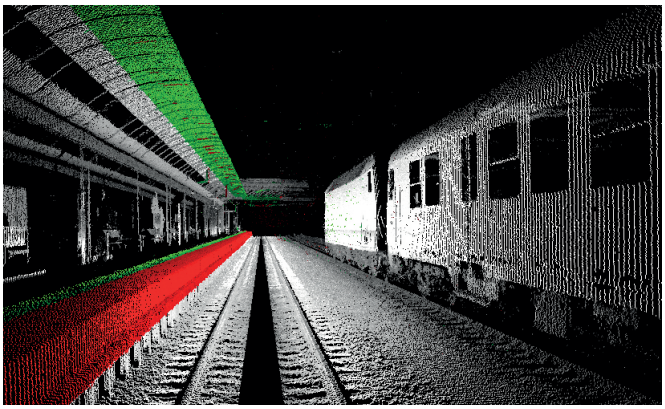
Two laser modules per sensor head

The HSP sensor is mounted at the inspection car's front or back. Its sensor head comprises two distance measuring systems: High-frequency modulated laser beams are deflected on the surroundings by a rotating mirror. A collecting lens focuses the returning light on two detectors. Phase shift technology is used for determining the distance. The exact position of each measurement point is calculated from the distance value and angle of the scanning mirror. A two-dimensional image is derived from the mirror's rotational movement, the inspection car's motion provides the third dimension.

With a rotation speed of up to 277 revolutions per second and a sampling frequency of 1 MHz, each beam measures 3,600 distance values per rotation. In this manner, 554 profiles per second are measured by one sensor head. They are processed and displayed by a dedicated computer inside the inspection car before transferring the data to the inspection car's PC network.

Railroad measurement systems
by Fraunhofer IPM

Fraunhofer IPM develops optical measuring systems for monitoring the condition of rail infrastructure. Experts in measuring techniques and optics, designers, electrical and software engineers work together on supplying turn-key solutions for the special requirements of infrastructure operators and providers of surveying services. The robust measuring systems are deployed throughout the world and are characterized by their speed, precision and reliability.



Left: Image based on profiles taken with HSP, analyzing the clearance
Right: HSP system with two sensor heads mounted on the Deutsche Bahn inspection train LIMEZ III

Robust housing

The sensor unit comprises a fixed optical window and is located in a hermetically sealed housing. When not in operation, a casing protects the sensor head from dirt or vandalism. It is combined with a semi-automatic cleaning system for the optical window allowing to easily regain full accuracy after extended operation periods in dirty environment. Interface requirements on the carrier are minimal. The HSP design is in accordance with EN 60825-1:2001-01.

Modular design – complete solution

Several sensor heads can be arranged at the vehicle's front covering extreme speed and resolution requirements. For instance, a system consisting of three heads yields one clearance profile every 17 mm at 100 km/h.

Fraunhofer IPM installs the HSP on site and provides training of the operators. Delivery includes a supply unit as well as an industrial PC which stores and processes the data automatically. The data can be transmitted to a network via TCP/IP. The High Speed Profiler HSP is eye-safe according to IEC60825.

Technical specifications

Measurement range	1.5 – 10 m
Distance resolution	about 1 mm
Intensity resolution	12 bit
Uncertainty at an object reflectivity of 90 %	3 mm at 5 m (σ-value)
Uncertainty at an object reflectivity of 10 %	7 mm at 5 m (σ-value)
Scanning angle	≈ 350°
Scanning speed	277 rev./s
Profiling speed	554 profiles/s
Measurement rate	2 × 1 mio. measurements per s
Number of measurements per profile	3,600 corresponding
Point distance at 5 m	8.7 mm
Profiling density at 50 km/h	one profile every 2.5 cm
Ambient temperature	– 20 °C to + 70 °C (in operation; temp. control incl.)

All specifications and features are subject to modification without notice.

CLASS 1
LASER PRODUCT

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