



SMV

Laser-based ballast monitoring at turnouts



Problem description

The importance of proper ballast tamping in turnouts

Proper ballast tamping in turnouts is vital for safe, efficient operations. Inadequate tamping can cause dips, humps, and misalignments – affecting train stability and detected by measurement trains.

Beyond visible issues, poorly compacted ballast increases dynamic forces on turnout components – especially point machines – causing hidden vibrations that accelerate wear and raise maintenance needs.

Over time, this leads to higher costs and downtime. Consistent, high-quality tamping stabilizes the track, reduces damage, and extends asset life, improving overall network reliability.

Solution description

Monitoring turnout stability with laser sensors

SMV is an advanced solution for monitoring ballast conditions in turnouts – using up to four laser-equipped sensors per switch. These sensors measure displacement and vibration of the point machine supports relative to a fixed reference point. Measurements are taken both during train passages and throughout the day – ensuring continuous monitoring of track stability.

Data is transmitted via 4G to a secure cloud platform – where intelligent algorithms analyze the evolution of key parameters. The system detects abnormal movement or excessive vibration – and automatically triggers alerts for asset managers.

By identifying early signs of ballast degradation – often undetectable by standard inspections – SMV supports predictive maintenance, minimizes infrastructure risks, and enhances track availability. It's a proactive, data-driven tool designed to protect critical turnout components and extend the operational lifespan of railway assets.

How it works

Main Features

- **Identify abnormal displacements:** The display board shows the live status of all connected point machines. Red alarms indicate abnormal vibration. Historical data from the past months can be reviewed.
- **Define where to prioritize tamping:** If vibration levels are increasing, the system predicts when orange and red thresholds will be reached. Alerts appear on the board when these dates approach.
- **Check tamping effectiveness:** Tamping operations are logged and visible on the board, allowing asset managers to easily evaluate the impact and quality of maintenance activities.

Hardware

SMV uses four laser sensors to monitor the movement of point machine supports, connected via cables to a recording box. In addition to displacement measurements, environmental data such as air temperature, humidity, and rail temperature are recorded.

Sensors operate 24/7, capturing data every 5 minutes, while each train passing is recorded every 15 seconds. This continuous data collection ensures accurate monitoring of turnout conditions.

Data is transmitted via 4G once a day to a secure data processing platform, where it undergoes automatic analysis and computing. The results are displayed for immediate review. All relevant data is then sent to the customer, allowing for proactive maintenance and decision-making.



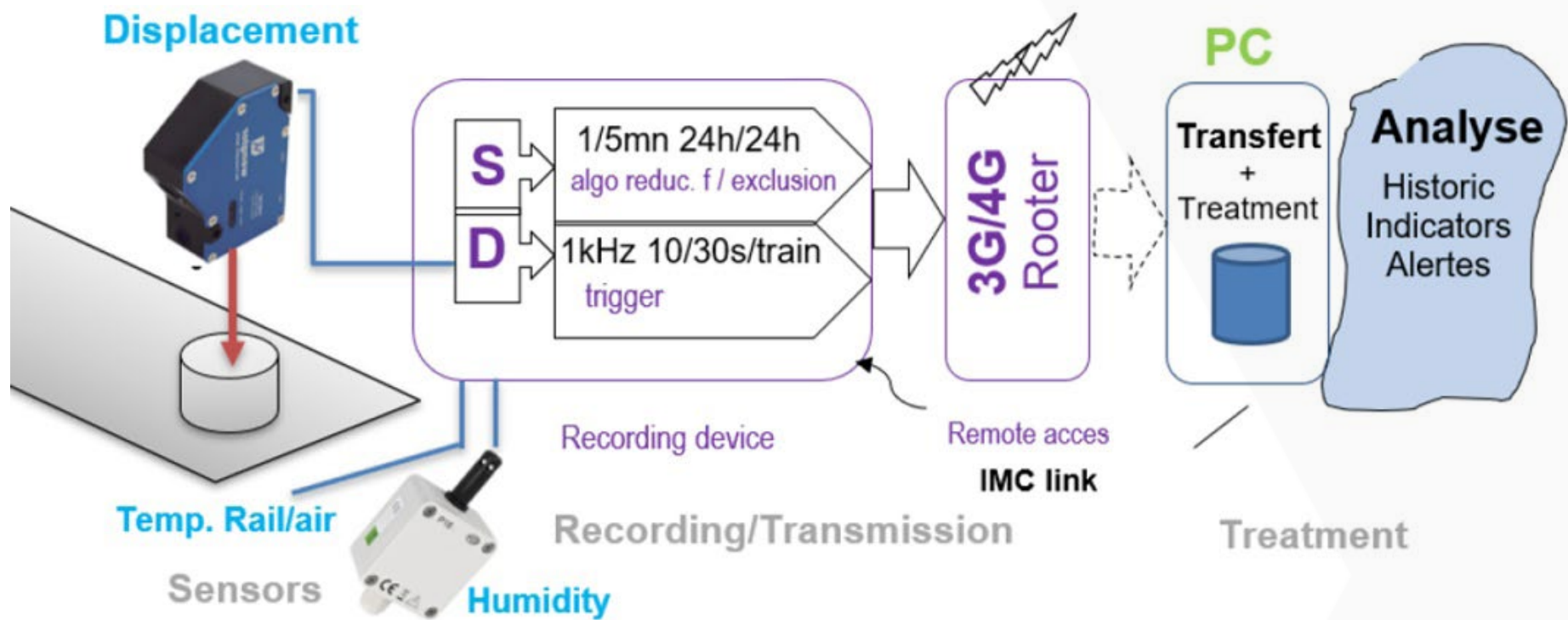
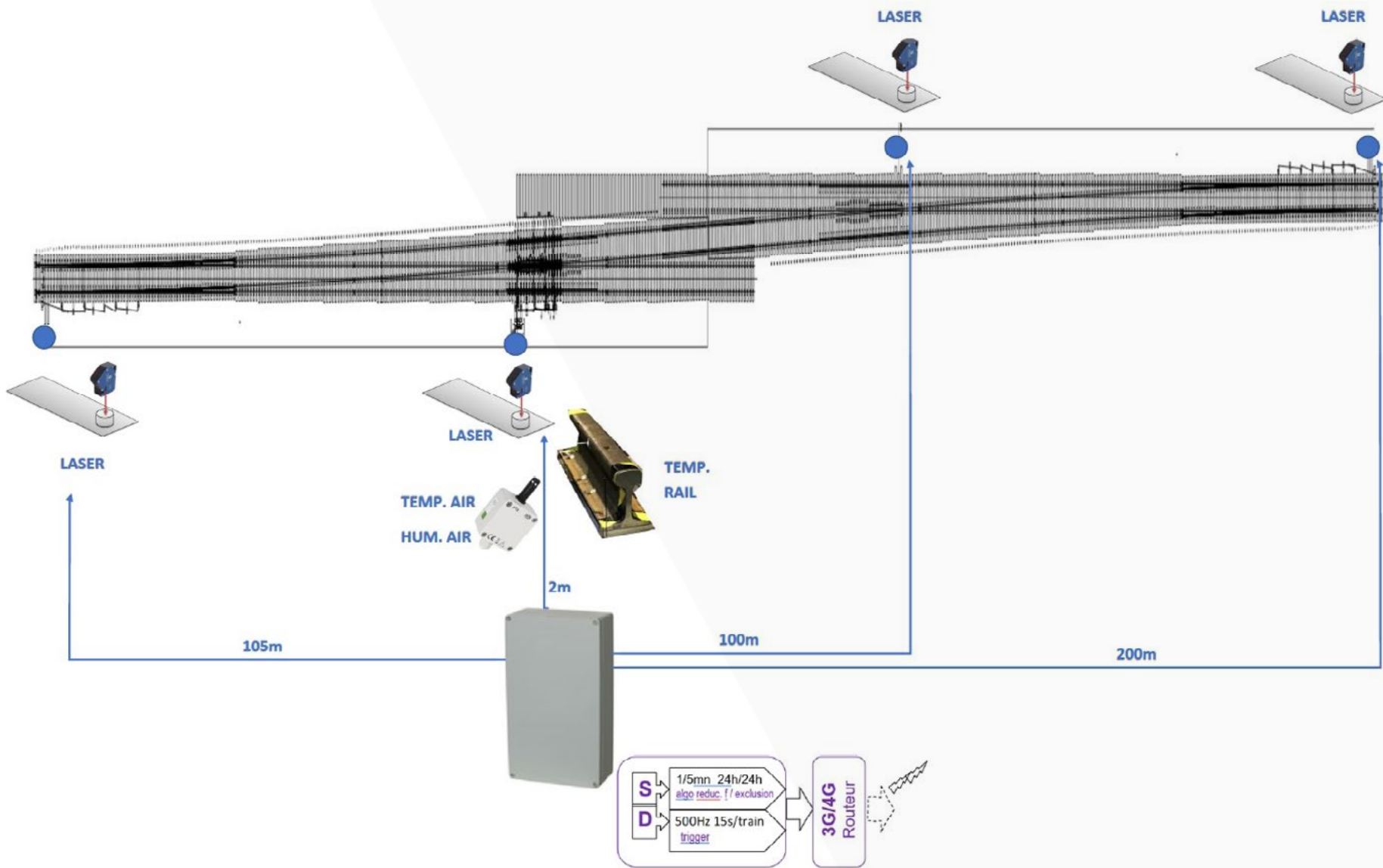
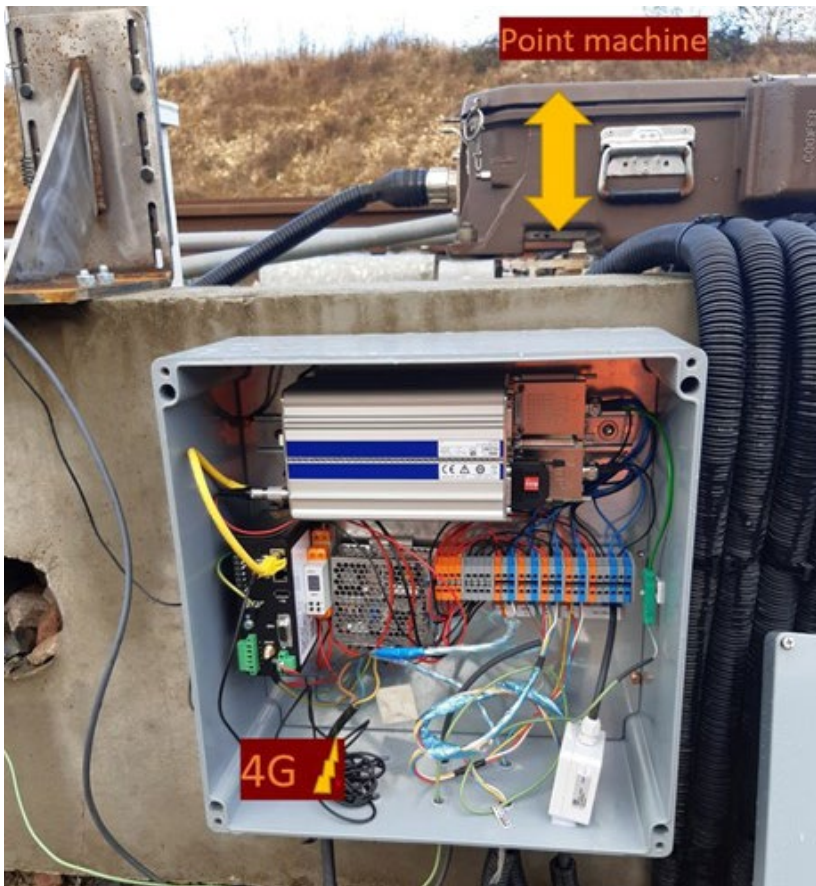


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Setup

Example of a setup consisting of a laser sensor and the necessary recording device and router.



Number of Laser Sensors	Up to 4 laser-equipped sensors per turnout for displacement and vibration monitoring
Measurement Type	Measures displacement of point machine supports compared to a fixed asset
Measurement Frequency	Continuous measurement 24/7 (every 5 minutes) and during train passages (every 15 seconds)
Data Transmission	Signal sent via 4G to a cloud application for real-time data processing and analysis
Data Processing	Cloud platform monitors key parameters and applies algorithms for accurate notifications
Alarms	Alarms notify asset managers of abnormal ballast conditions and potential risks
Environmental Measurements	Air temperature, humidity, and rail temperature recorded for comprehensive analysis
Data Display	Results displayed in real-time for asset managers to access and take action
Customer Access	Data sent daily to the customer for review, proactive maintenance, and decision-making