



DIGITAL SOLUTIONS FOR AN OPTIMIZED TRACK AVAILABILITY

Pierre Henri BOUGEANT
21/11/2024

VOSSLOH'S UNIQUE POSITIONING



WE ARE MANUFACTURERS



WE ARE MAINTAINERS



WE ARE DIGITAL

A unique positioning in the market to answer our industry challenges:

OUR DIGITAL REFERENCES

100+ NETWORKS, 1000+ USERS

Main lines



High-speed lines



Urban public transport



Industrial



VOSSLOH CONNECT

PRODUCTS & SERVICES



SMART POINT MACHINE



DIGITAL LOGISTIC PLANNER



SMART TURNOUT



DATA LAB



RAILWATCH



MR.PRO



SMV



CERVELLO



STRAINLABS



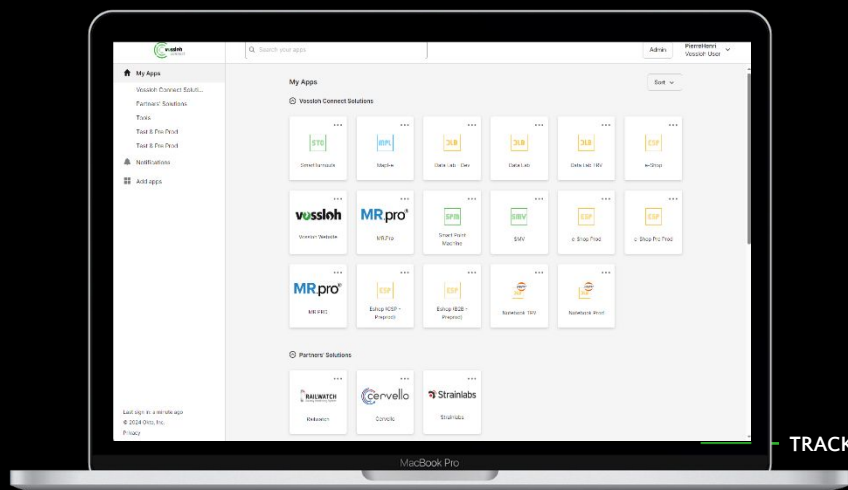
E-SHOP



ANY'R



MAPL-E



TRACK SIDE

SENSOR AGNOSTIC

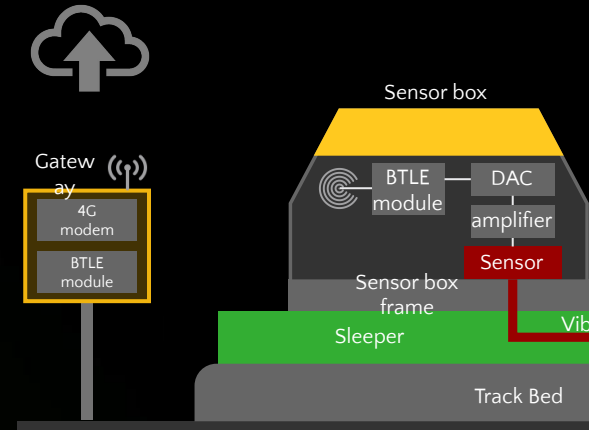
TRAIN SIDE

COMMUNICATION

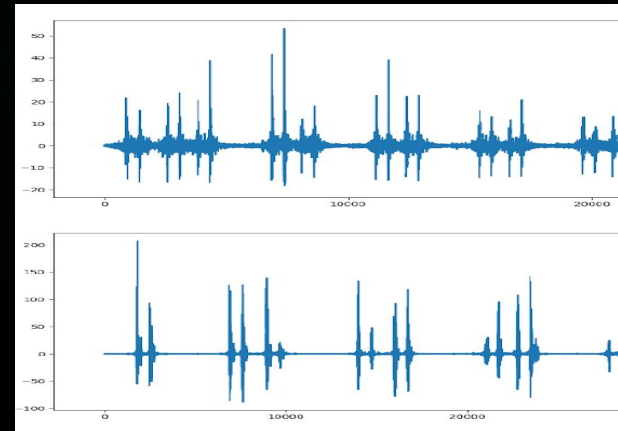
CROSSING MONITORING

PREDICTIVE AND CONDITION-BASED MAINTENANCE

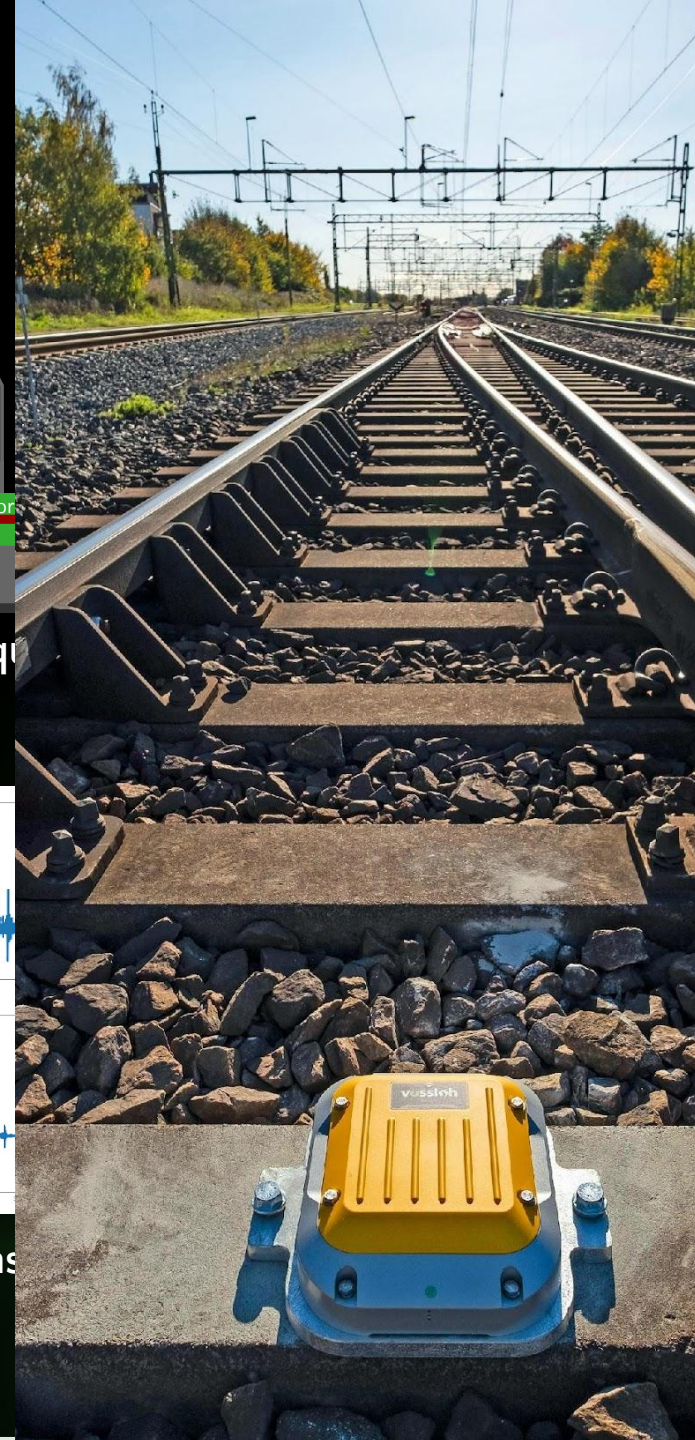
- / Battery powered sensors with accelerometer and thermometer
- / 4G gateway (battery powered)
- / Storage for up to 1 week of train passage if no 4G network.
- / Vertical displacement and acceleration
- / Train recognition with pattern recognition
- / Train speed measurement to provide an additional factors to get more relevant insights



Representation of the acquisition



Examples of accelerations patterns



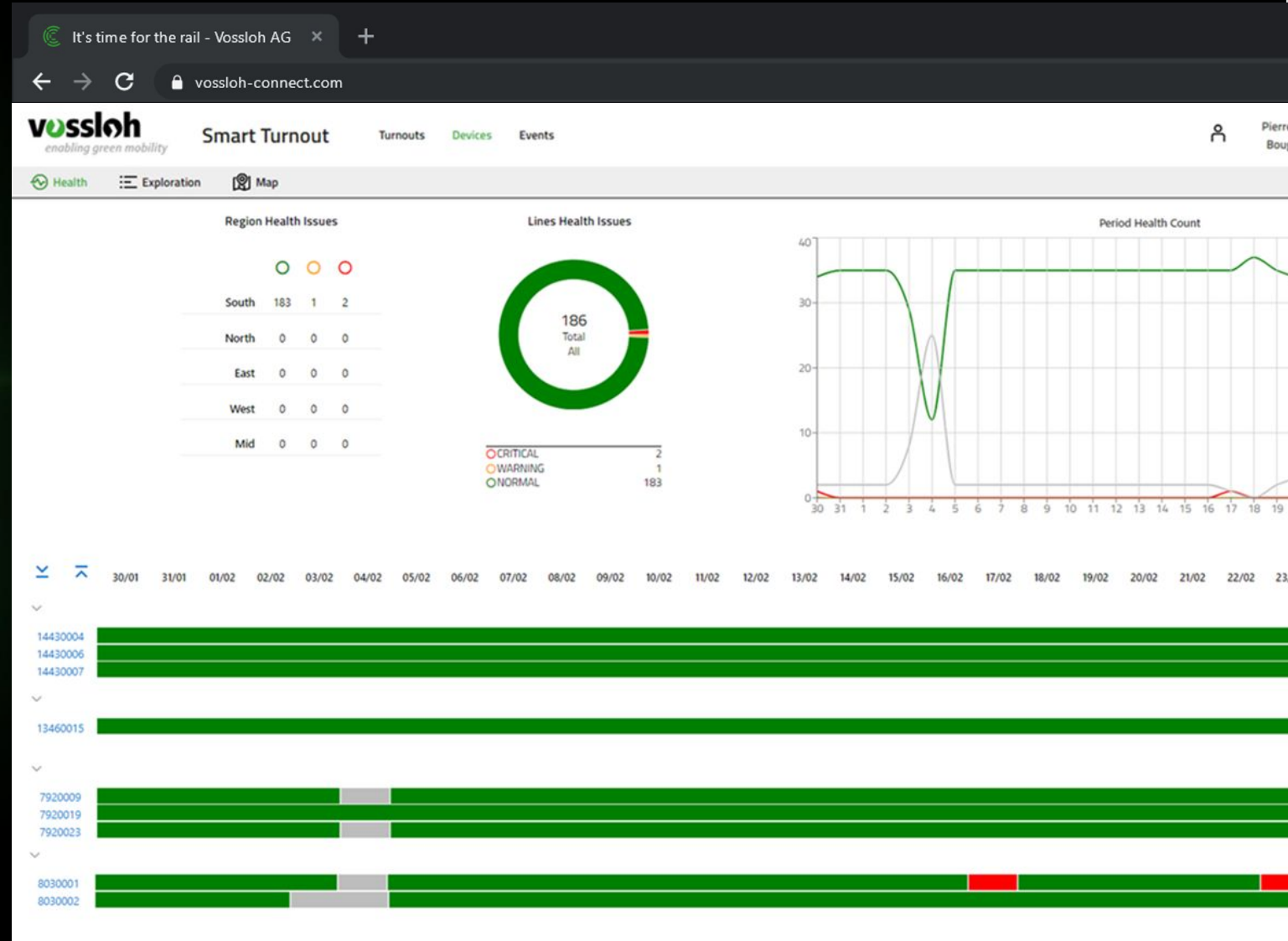
MONITORING OF A DYNAMIC BEHAVIOR



PRIORITIZATION OF ACTIONS

A dashboard that displays all monitored assets offers :

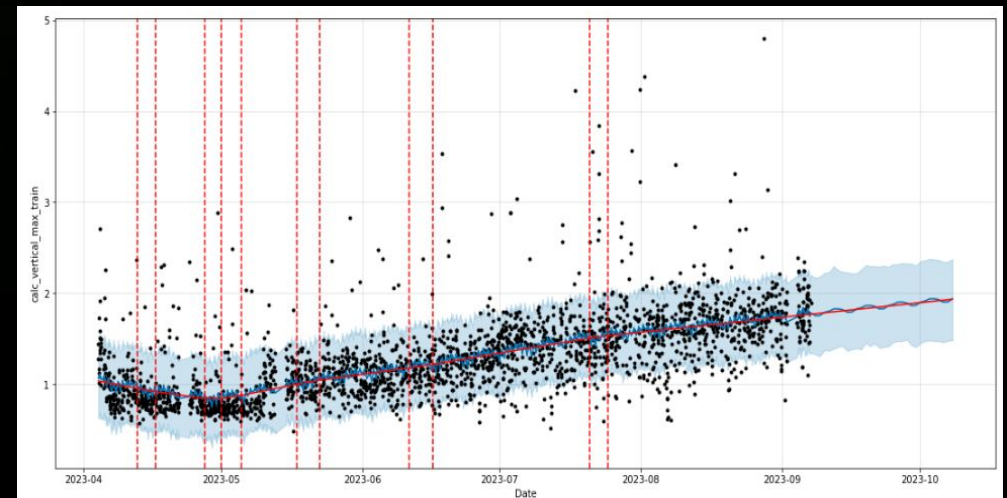
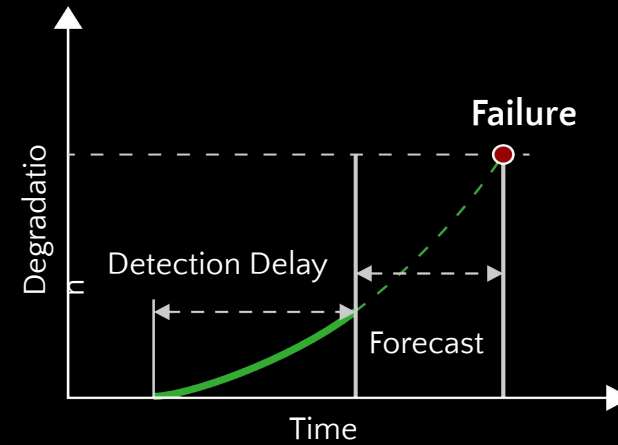
- Enhances decision-making on real-time asset data.
- Improves efficiency reducing time spent on manual checks
- Optimizes maintenance schedules: predictive insights allow for proactive maintenance.
- Reduces operational costs: prevents costly failures and optimizes resource allocation.



FORECASTING DISPLACEMENT

Analysis of clusters and forecasting behavior can significantly enhance operational efficiency by:

- **Streamlining Data Management:** Filters critical insights from vast datasets, preventing data overload.
- **Proactive Maintenance Planning:** Predicts potential failures, enabling timely preventive measures.
- **Enhancing Resource Allocation:** Optimizes deployment of resources by prioritizing areas of concern.

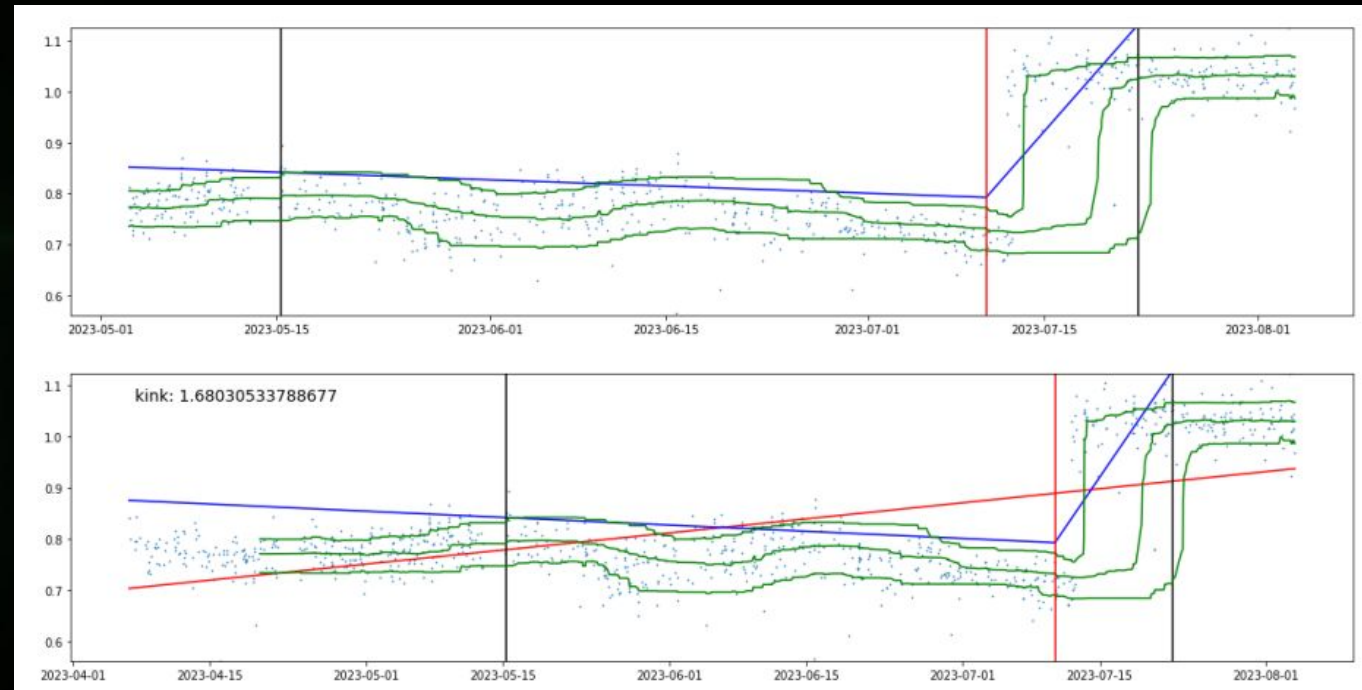


6-week forecasting of composite axle displacement

EVENT IDENTIFICATION

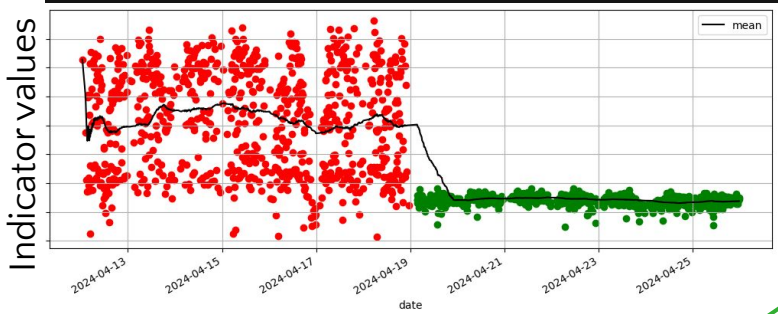
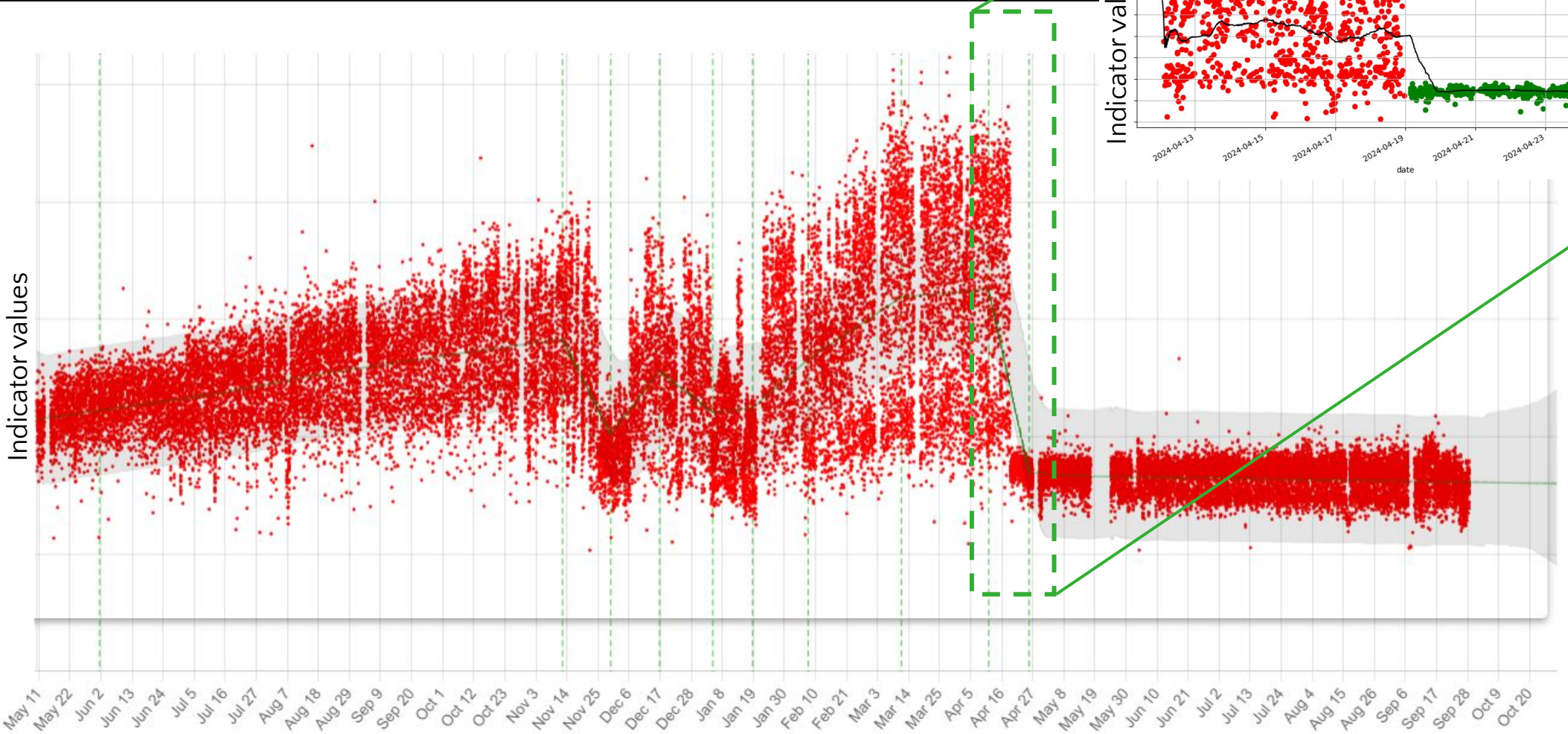
Monitoring assets through advanced systems enables managers to detect rapid behavioral changes :

- Preventing catastrophic events and ensuring operational continuity.
- Ensuring that each action contributes to the asset's optimal performance and longevity.
- (reversed) Check impact of maintenance (eg tamping)



Examples of rapid changes

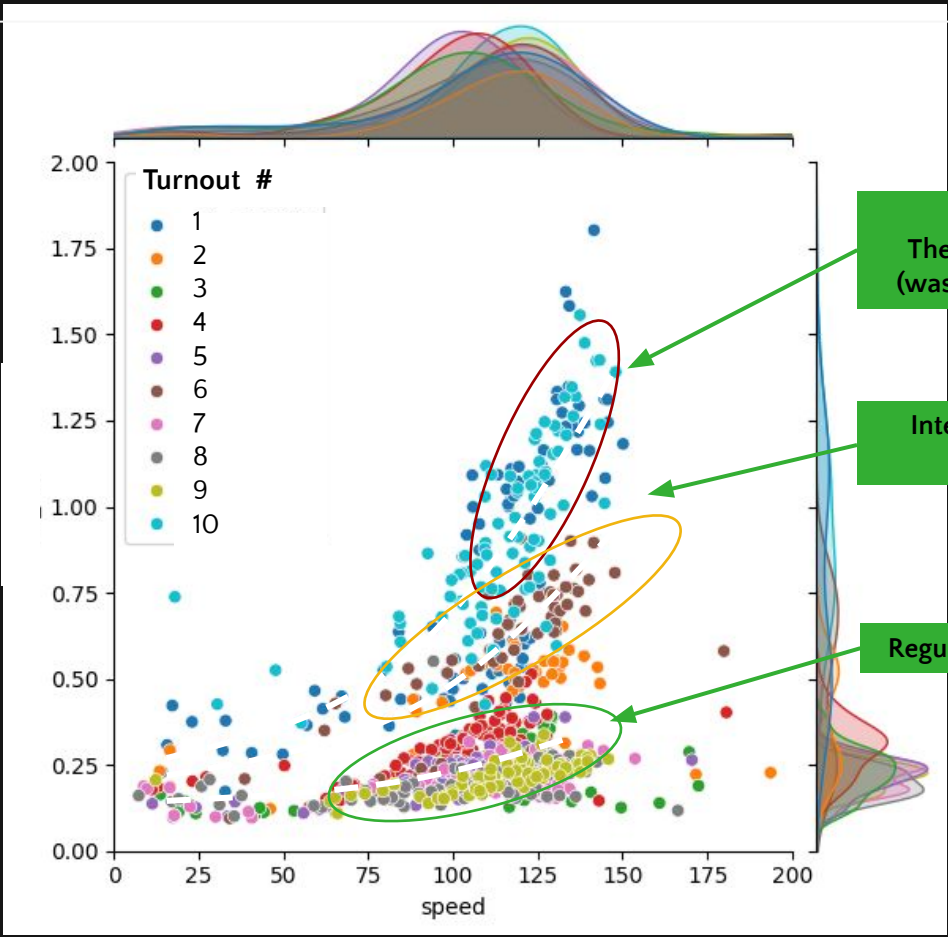
CROSSING NOSE INDEX



202

202

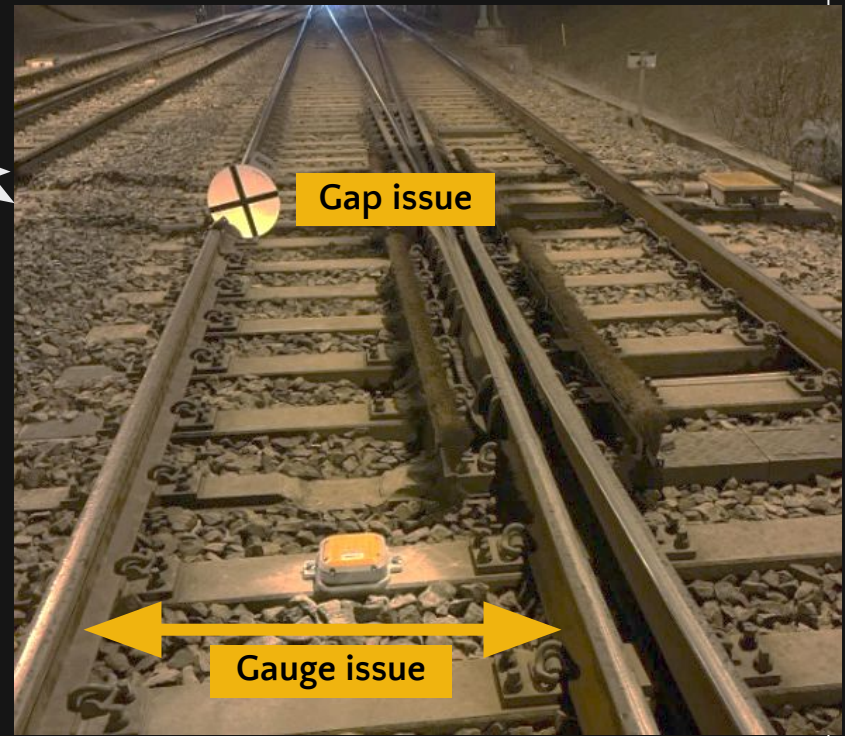
TURNOUT GEOMETRY



Abnormal behaviour:
These two turnouts need maintenance
(was confirmed from on-site inspection)

Intermediate behaviour □ will require
maintenance in a mid-term

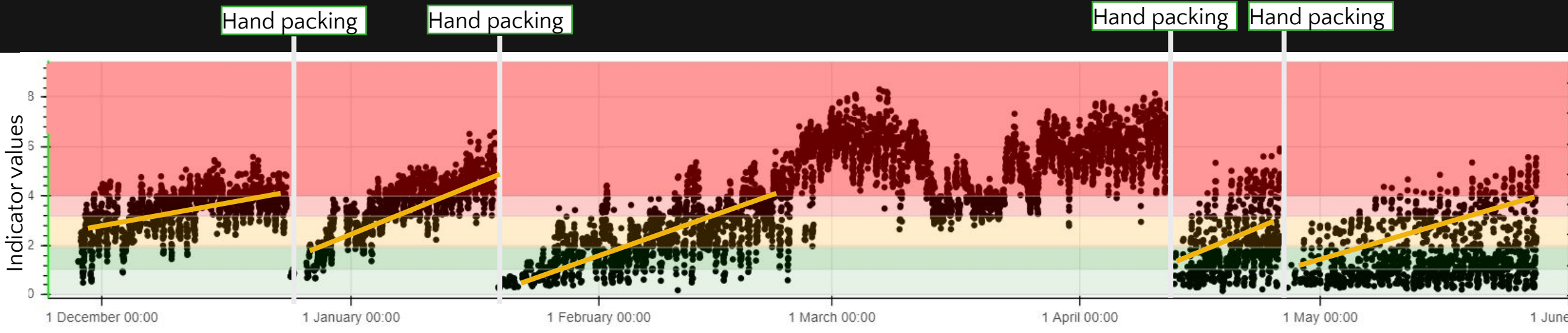
Regular behaviour



BALLAST TAMPING INDICATOR

The indicator shows the effect of ballast hand packing around the turnout

Each point is a train passage



Short term view:

- Compare ballast tamping processes

Mid term view:

- Project the evolution to anticipate ballast tamping

Long term view:

- 4 hand packings required in about 4 months
- Rapid degradation after hand packing
- The ballast is close to the end of its life

VOSSLOH CONNECT PRODUCTS & SERVICES



SMART TURNOUT



DATA LAB



SMART POINT MACHINE



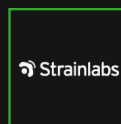
MR.PRO



SMV



CERVELLO



STRAINLABS



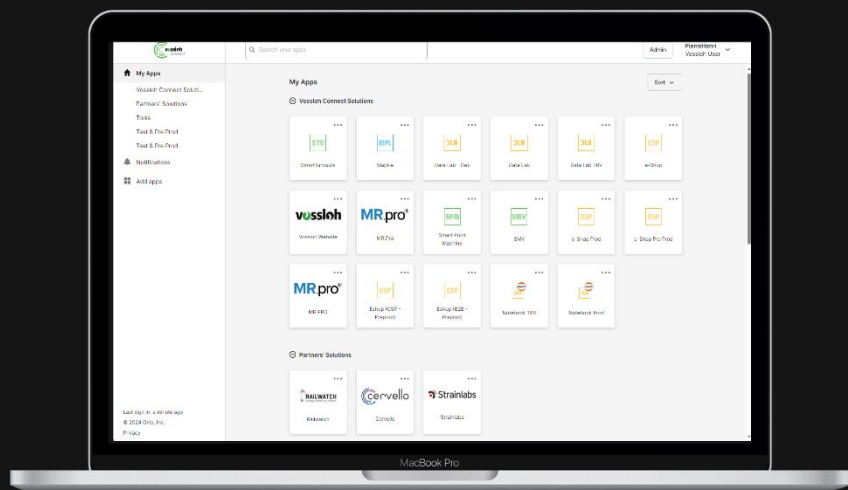
E-SHOP



RAILWATCH



MAPL-E



TRACK SIDE

SENSOR AGNOSTIC

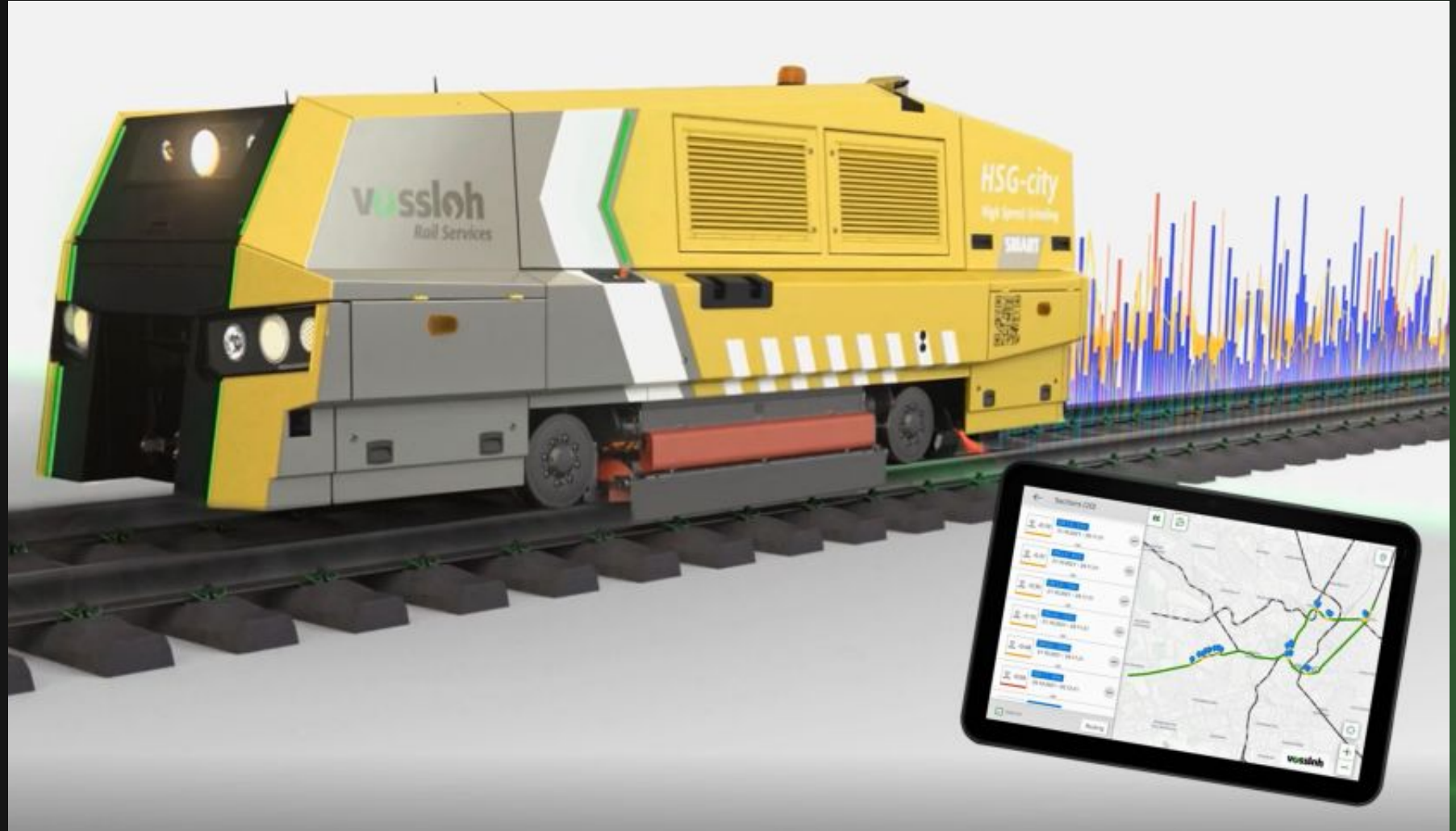
TRAIN SIDE

SMART MAINTENANCE

LASER RAIL SCANNING

Non-contact rail & track measurement system

- / Optical technology with laser triangulation sensors
- / Completely integrated in our machines
- / Measurement up to 60 km/h (HSG-city) or 80 km/h (HSG-3)
- / Continuous measurement with real time data processing



SMART MAINTENANCE

LASER RAIL SCANNING

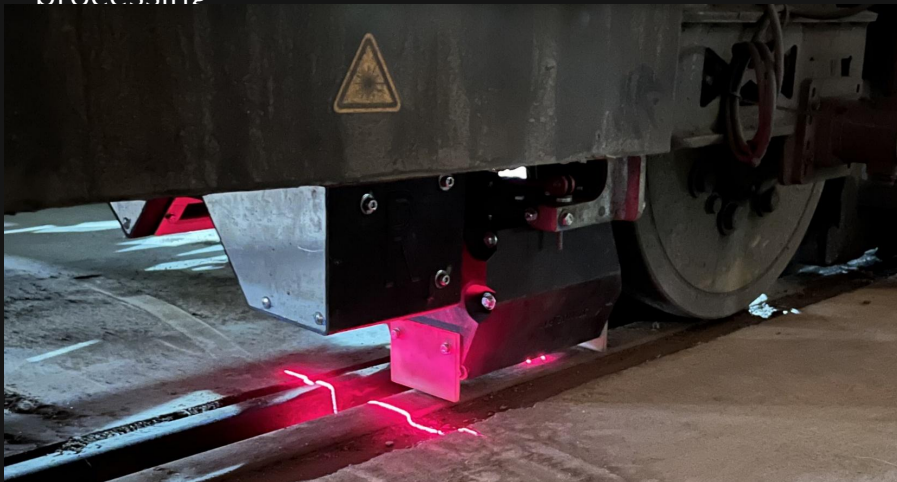
Non-contact rail & track measurement system

/ Optical technology with laser triangulation sensors

/ Completely integrated in our machines

/ Measurement up to **60 km/h** (HSG-city) or **80 km/h** (HSG-3)

/ **Continuous** measurement with **real time** data processing



WiFi
4G



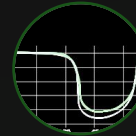
Wireless control/monitoring of meas.
Automatic data upload

WHEEL ROTATION
GPS



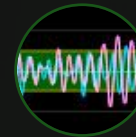
Distance
Position (also Tunnels with mapl-e)
Start/End measurement **anywhere**

TRANSVERSE
PROFILE



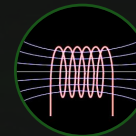
Rail head geometry
Groove geometry
Vertical & Lateral **Wear**
Track **Gauge**

LONGITUDINAL
PROFILE



Corrugation

EDDY CURRENT
(ONLY HSG-3)



Head checks

SMART MAINTENANCE

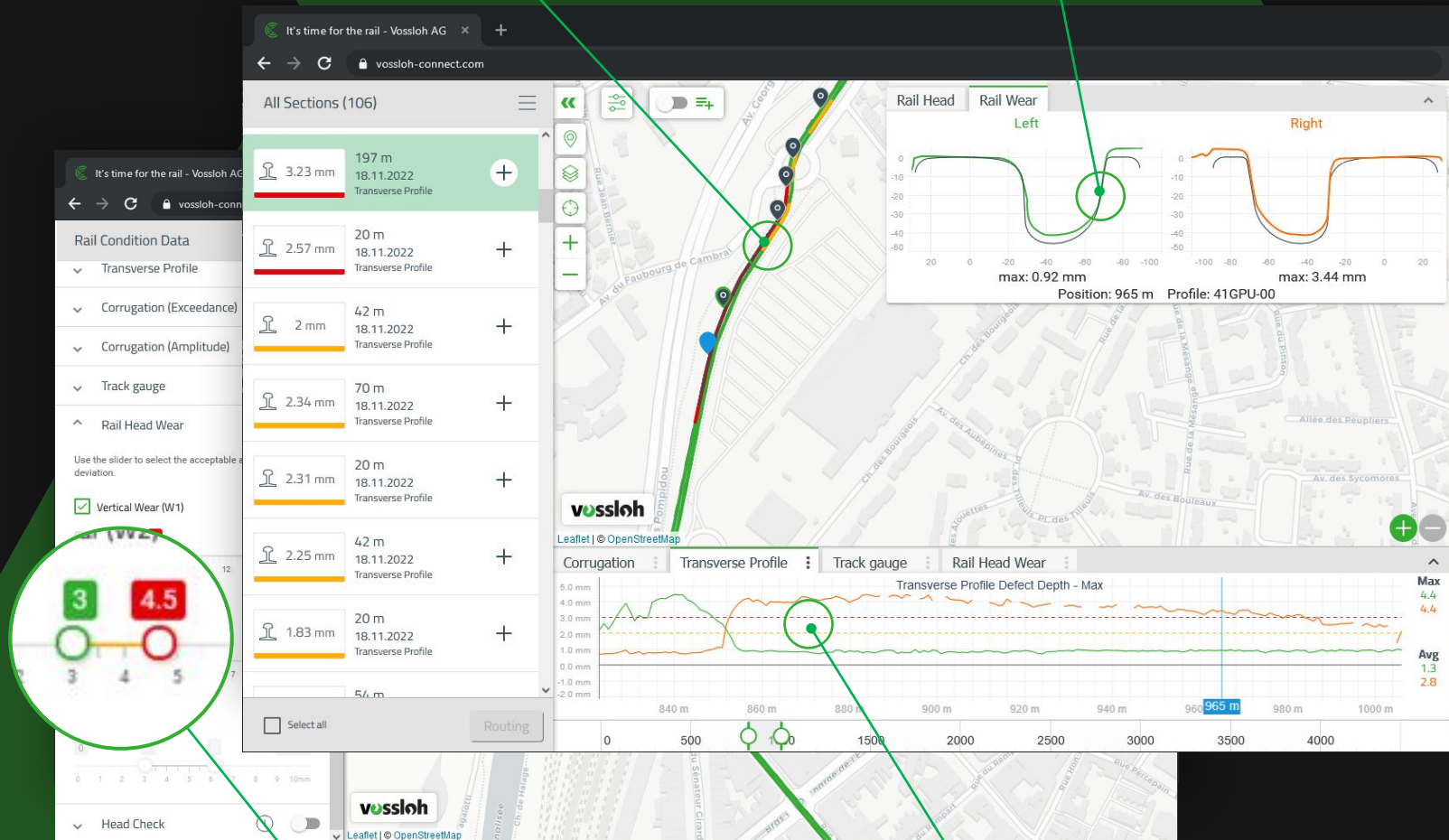
MAPL-E

Software for visualisation of rail condition & rail maintenance

- / Web-App with Cloud-platform, accessible from any device
- / Direct import of native Laser Rail Scanning (LRS) files
- / Powerful track identification and data alignment algorithm: start / end measurement anywhere
- / Systematic and thorough interpretation of the raw data
- / Own tolerance setup
- / User friendly interface with several level of information: Overview & Details
- / Simulation of maintenance scenario, Vossloh's machine pool is implemented

Color-coded visualization

Local data



Adjustable tolerance range

Section details plot

UI SHOWCASE



vossloh mapl-e Condition Events Maintenance

Overview Sections (48/90) My Sections (0)

Sort by: Length

HEAVY	568 m	2.27	491	+
HEAVY	434 m	2.00	491	+
HEAVY	377 m	1.50	491	+
HEAVY	328 m	2.2	491	+
HEAVY	264 m	2.07	491	+
LIGHT	224 m	1.00	491	+
HEAVY	197 m	1.06	491	+
HEAVY	195 m	2.11	491	+
LIGHT	177 m	1.74	491	+
LIGHT	143 m	1.15	491	+
LIGHT	129 m	1.01	491	+
LIGHT	126 m	1.7	491	+
HEAVY	726 m			+

Map view showing rail line with various markers and a zoomed-in view of a section.

Rail Head | Rail Wear | History

Left | Right

max: 0.86 mm | Position: 787 m | Profile: max: 3.53 mm

Rail Condition Data

Data	Prognosis	Period
Transverse Profile	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Corrugation (Exceedance)	<input type="checkbox"/>	<input type="checkbox"/>
Corrugation (Amplitude)	<input type="checkbox"/>	<input type="checkbox"/>
Head Check	<input type="checkbox"/>	<input type="checkbox"/>
Rail Head Wear	<input type="checkbox"/>	<input type="checkbox"/>
Track gauge	<input type="checkbox"/>	<input type="checkbox"/>
Cross Level / Twist	<input type="checkbox"/>	<input type="checkbox"/>

Transverse Profile Defect Depth - Max

Max: 3.5, Avg: 2.6

VOSSLOH CONNECT PRODUCTS & SERVICES



SMART TURNOUT



DATA LAB



SMART POINT MACHINE



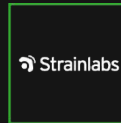
MR.PRO



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CERVELLO



STRAINLABS



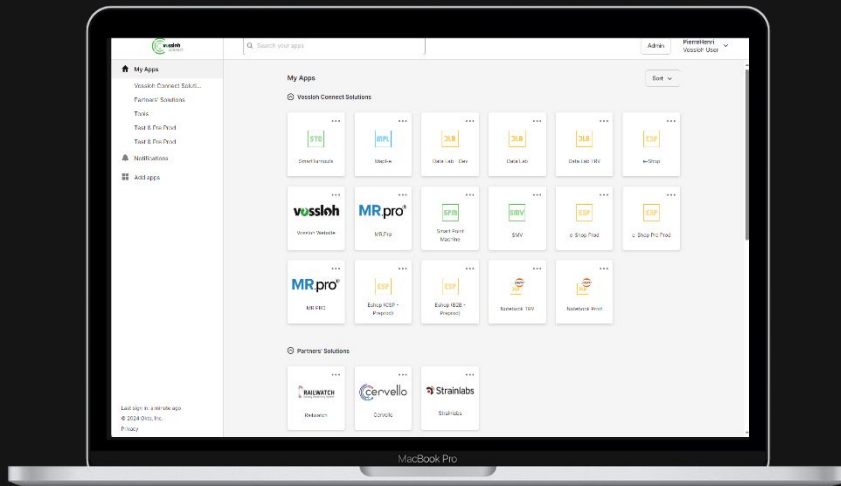
E-SHOP



RAILWATCH



MAPL-E



TRACK SIDE

SENSOR AGNOSTIC

TRAIN SIDE

RAILWATCH DESCRIPTION



Compact cabinet with optical, acoustic and other high-end technology to monitor rolling stock traffic.



Set up within one to two days, involve no approval effort and no installation in or above the track (following to feature)



The pulsars are set up to a maximum of 8 m next to the track and detect trains travelling at full speed of up to 200 km/h.



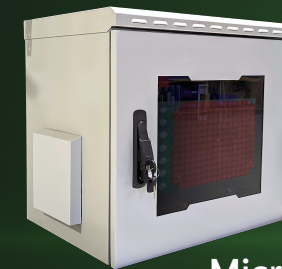
Need for technical operation a standard 230 V mains connection. Data transmission to the cloud usually takes place via LTE or 5G.



Pulsar



Mobile Pulsar



MicroPulsar
Prototype

MAIN FEATURES

Process Data



UIC-number detection



Wagon sequence



External view

Condition Data



Brake block thickness



Wheel condition & Wheelset damage



Hot brakes / hot axle detection



Dangerous Goods



Graffiti detection

RAILWATCH PORTAL



Fleetcheck

Traincheck

Dashboard

CONVENTIONAL LINES

CONVENTIONAL LINES



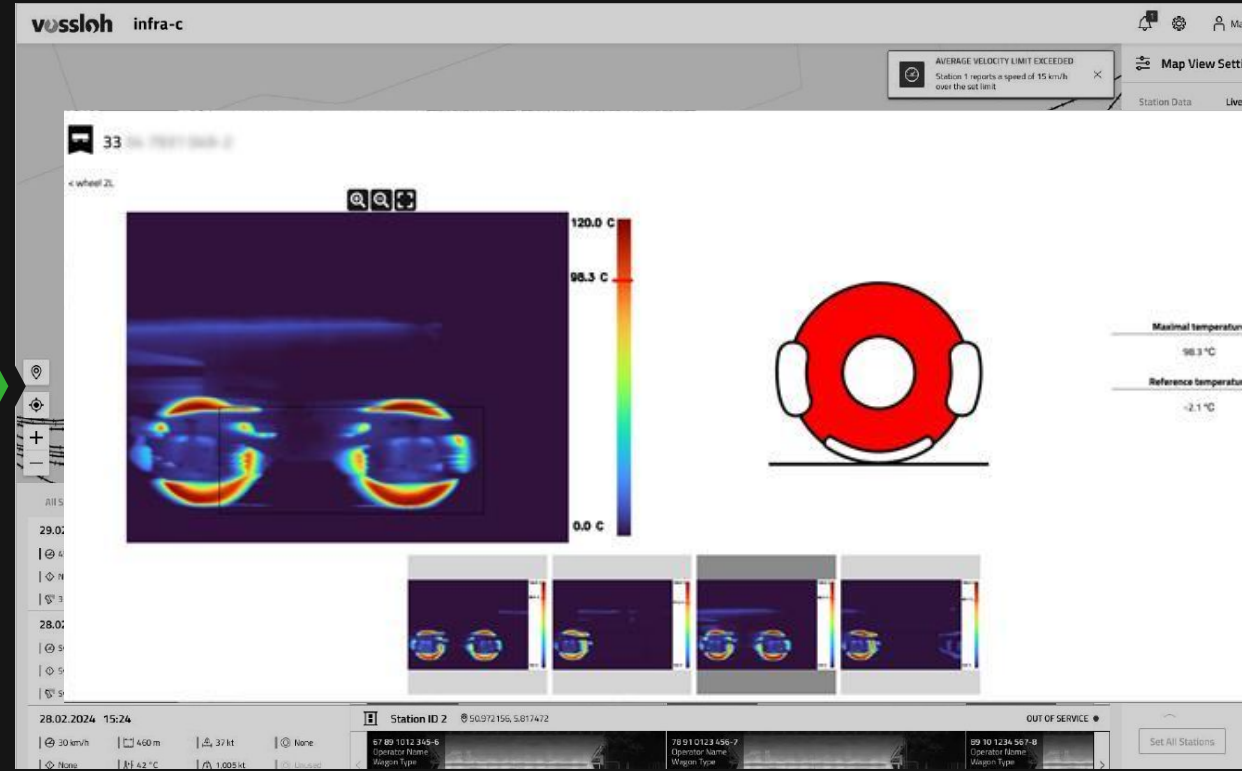
Latest events in north America or Europe have show the dramatic consequences of late identification of critical wagon condition.

PAIN POINTS

/ Stop trains / wagons that present an important risk of catastrophic event

Our SOLUTION

- / Customizable alarm thresholds to prevent :
 - / Hot axles / wheels / brakes
 - / Dangerous conditions in certain areas
 - / Excessive speed



Railwatch UI for Thermal imagery

CONVENTIONAL LINES

CONVENTIONAL LINES



With the increase of traffic and liberalization of network usage, mixed traffic with many players creates a huge pressure on networks

PAIN POINTS

- / Identify wheel sets abnormally degrading the track
 - / Flat spots
 - / Excess weights
 - / Degraded wheel profiles



Our SOLUTION

- / Allow identification of the train composition (Wagon, axles...) up to 200km/h
- / Customizable alarm thresholds by Pulsar Station
- / Detailed reports per station / fleet

Date	Time	Speed	Distance	Weight	Status
29.02.2024	11:32	45 km/h	420 m	3 t	None
28.02.2024	18:09	30 km/h	460 m	3 t	None
28.02.2024	15:24	30 km/h	460 m	3 t	None

Railwatch UI for networks

VOSSLOH CONNECT PRODUCTS & SERVICES



SMART TURNOUT



DATA LAB



SMART POINT MACHINE



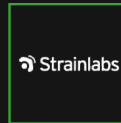
MR.PRO



SMV



CERVELLO



STRAINLABS



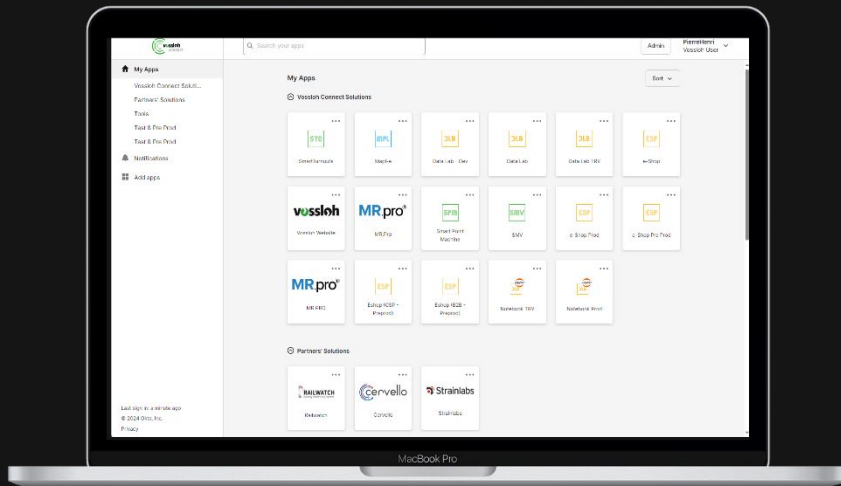
E-SHOP



RAILWATCH



MAPL-E



TRACK SIDE

SENSOR AGNOSTIC

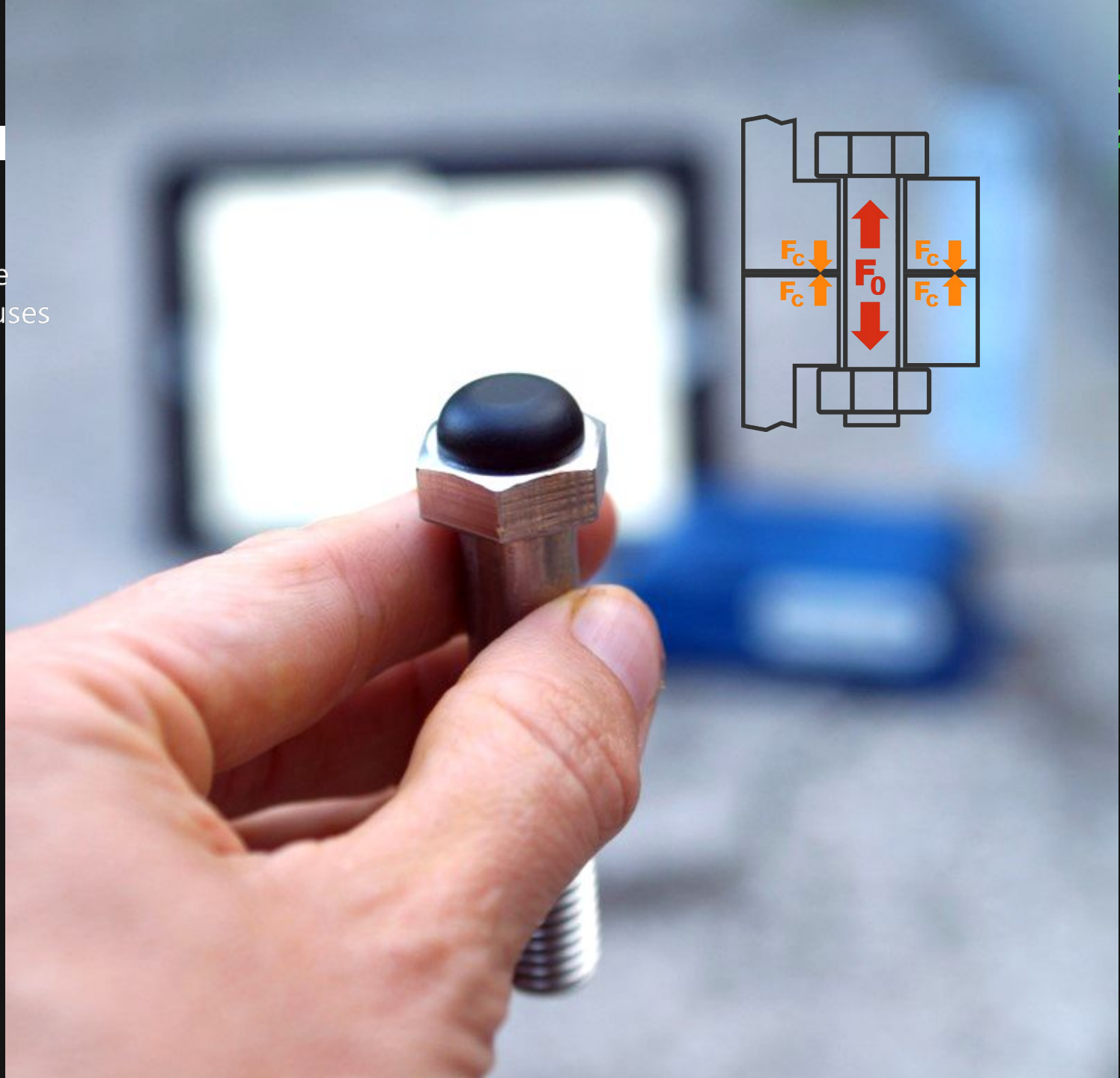
TRAIN SIDE

STRAINLABS PRESENTATION

Bolt preload (F_0) is the axial force in the bolt introduced by tightening which causes a reactive clamping force (F_c)

Correct bolt preload is what makes a bolted joint work.

- **Sensorized bolts** measure preload every 10 minutes
- **Automated monitoring process with alerts**
- **Accurate data**
- **Cost savings**
- **Increased uptime**
- **High safety**



STRAINLABS : CONNECTED BOLTS

Cost-Efficient Monitoring for many use cases

- Example : monitoring one crossing with 4 bolts: €2K (-€1/day)

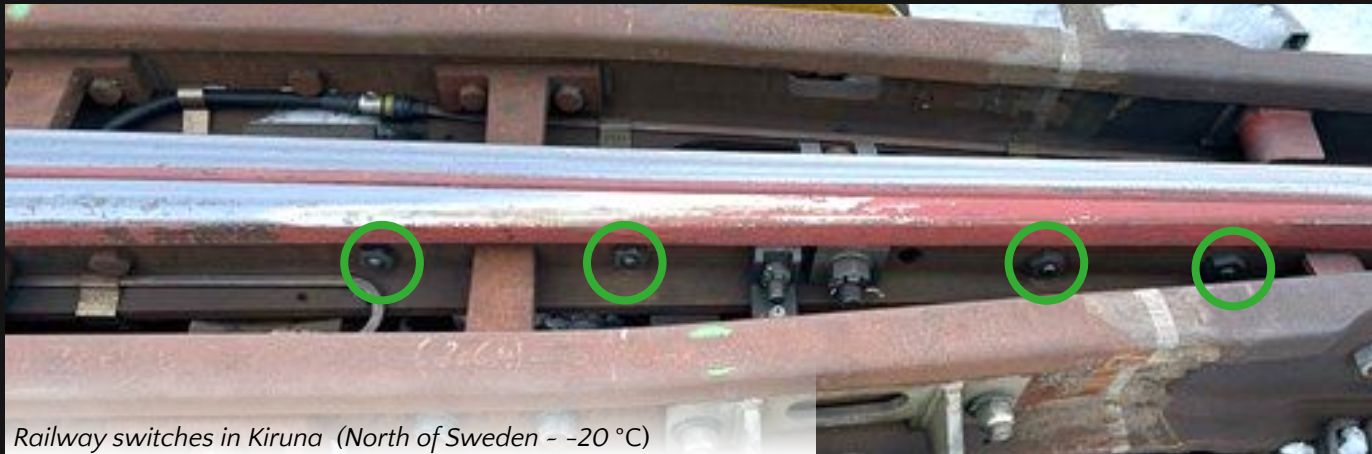
Innovative Solution

- Strainlabs & Vossloh Nordic partner to digitalize bolted joints for safer, smarter railways where it matters

Bolt monitoring a solution to enhance safety of tracks and rolling stock

- Fishplates
- Rail assembled crossings
- Glued insulated joints

But also for other sub systems non safety critical



Switch to
highest track availability
and **efficiency**

THANK YOU



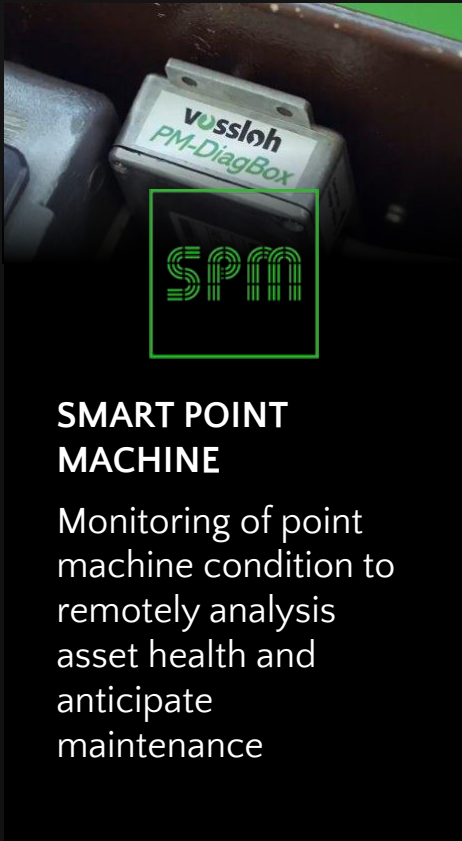
PIERRE HENRI BOUGEANT



3

OTHER SOLUTIONS

SMART POINT MACHINE

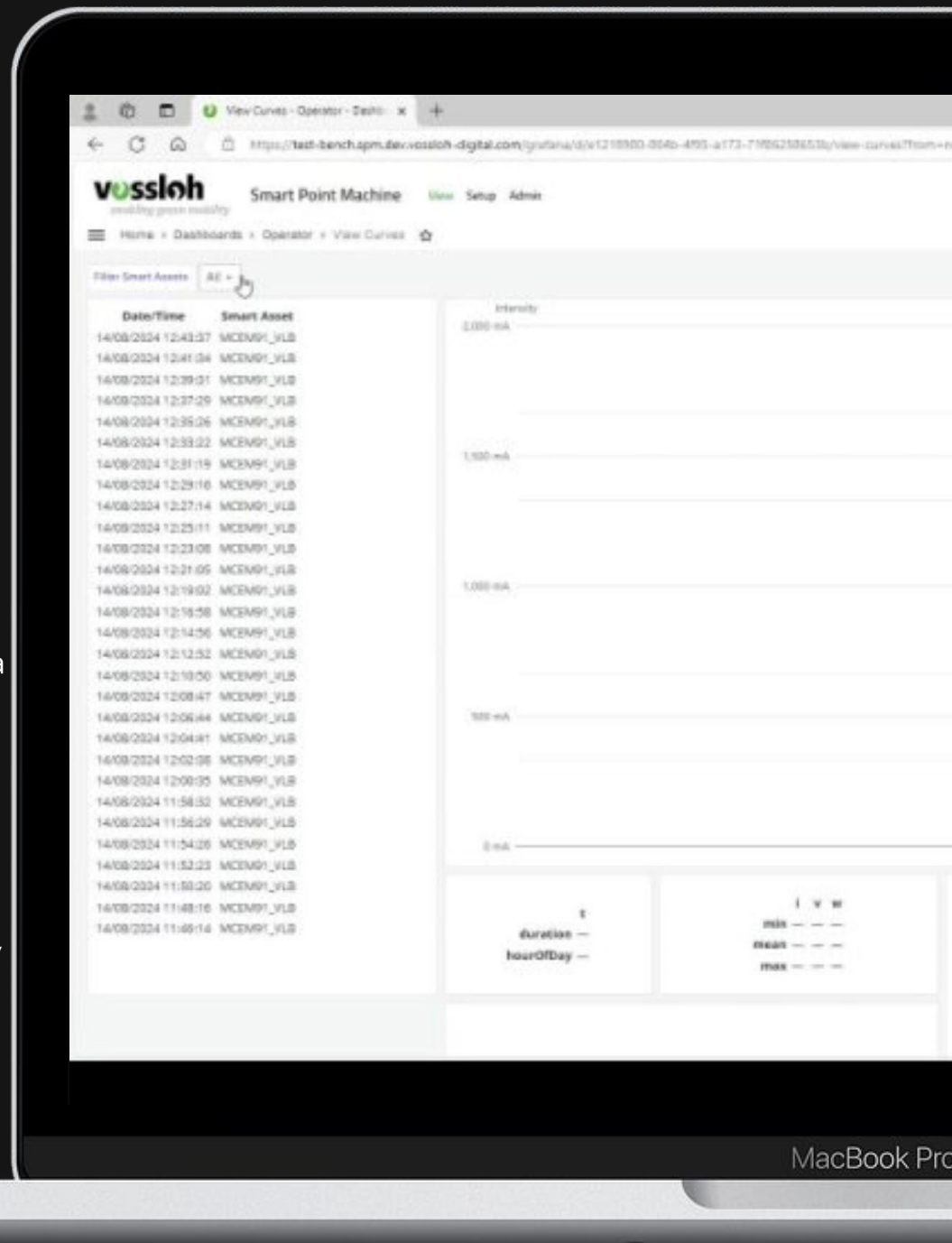


FEATURES

- / a modular solution adapted to the customer's needs and priorities
- / A cockpit dashboard to identify your critical assets at a glance and where to deploy maintenance.
- / The Monitoring of Vibration and Displacement to check the evolution of these parameters to anticipate a possible failure
- / Data coming directly from the motor = more reliable information

PRODUCT BENEFITS

- / to identify which point machine behave abnormally by providing a dashboard with above threshold behaviour. It allows as well to anticipate evolution of degradation and plan/ prioritize maintenance.
- / Overall, you can plan better your maintenance activities by adjusting the execution of track,



SMV



SMV

Monitoring of Point machine support behavior to anticipate tamping operation

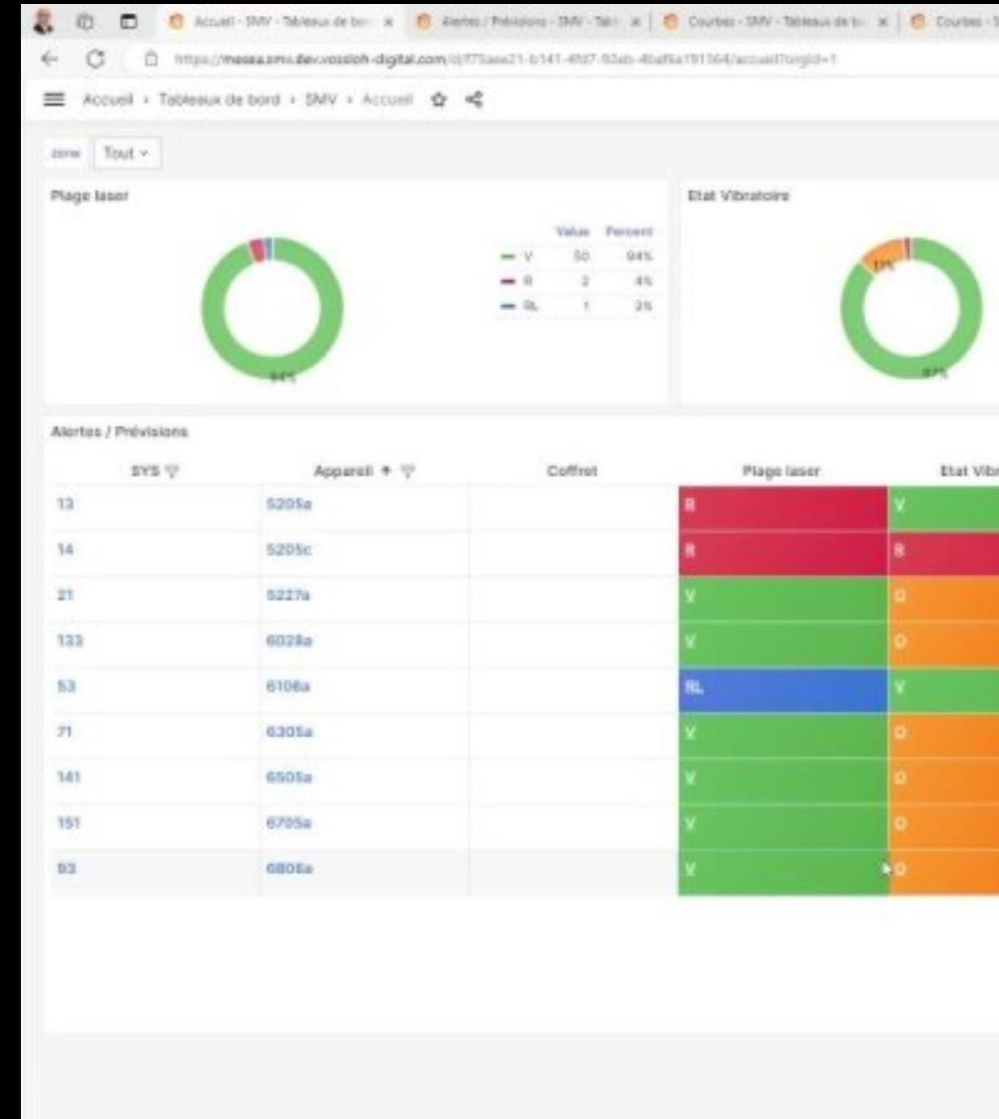
mesea

FEATURES

- / Identify abnormal ballast displacements, The
- / Define where prioritize tamping , an alarm appears on the board if the dates are in a near future.
- / Check tamping effectiveness, The tamping operations are visible on the board, so that it is easy to assess the quality of this maintenance event.

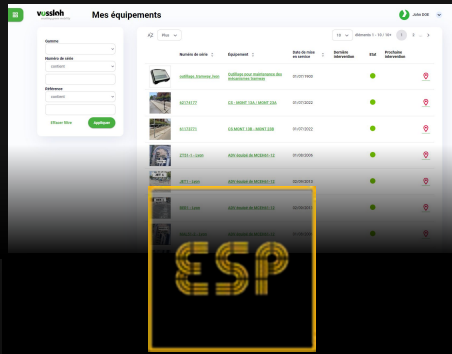
PRODUCT BENEFITS

- / Warn the maintainer when to perform tamping operation to avoid failures of point machines.
- / Check that the tamping has been effective by checking displacement measures.
- / The solution has proved it anticipates the behavior of the track to allow the planning of tamping action prior to an issue and allows the right action to avoid failures.



MacBook Pro

E-SHOP



E-SHOP

Our platform to see your Vossloh turnouts and get spare parts and documentation easily

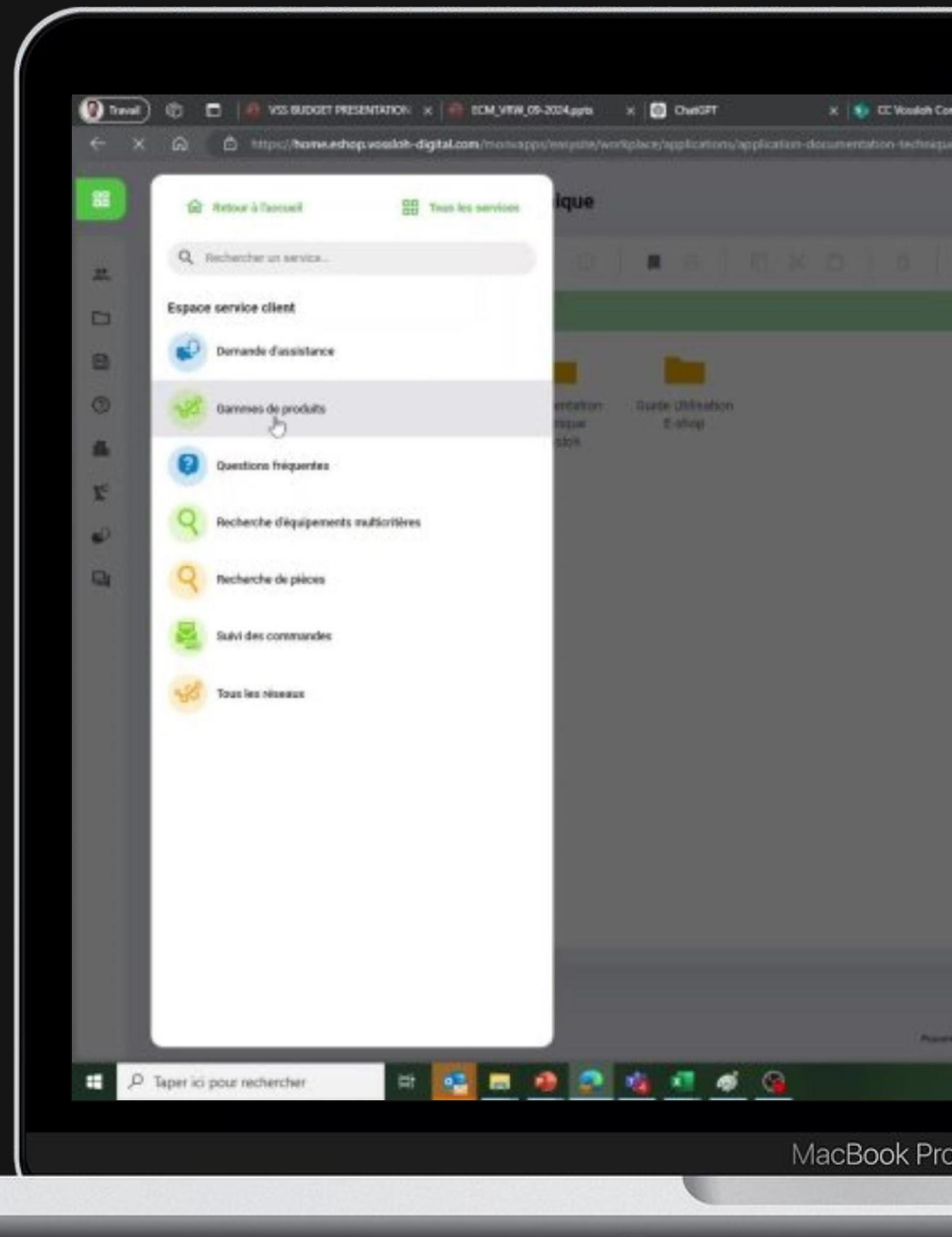


FEATURES

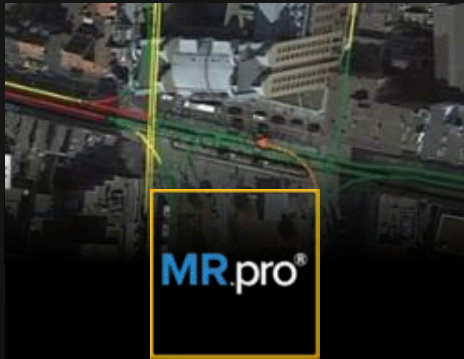
- / Identification and localization of assets on railway track, and access to the list of relevant spares.
- / Access to all technical documentation related to equipment's: maintenance manuals, technical specs, drawings.
- / Store to purchase services, training, accessories, consumables.

PRODUCT BENEFITS

- / Simplify value selling process on spares (RFQ-Offer-Order Entry)
- / Ensure traceability of requests (spare parts, on-site interventions)
- / Share documentation and ensure it is updated (maintenance booklets)



MR.PRO



MR.pro

Monitoring and control of scheduled jobs, such as revisions, inspection much more

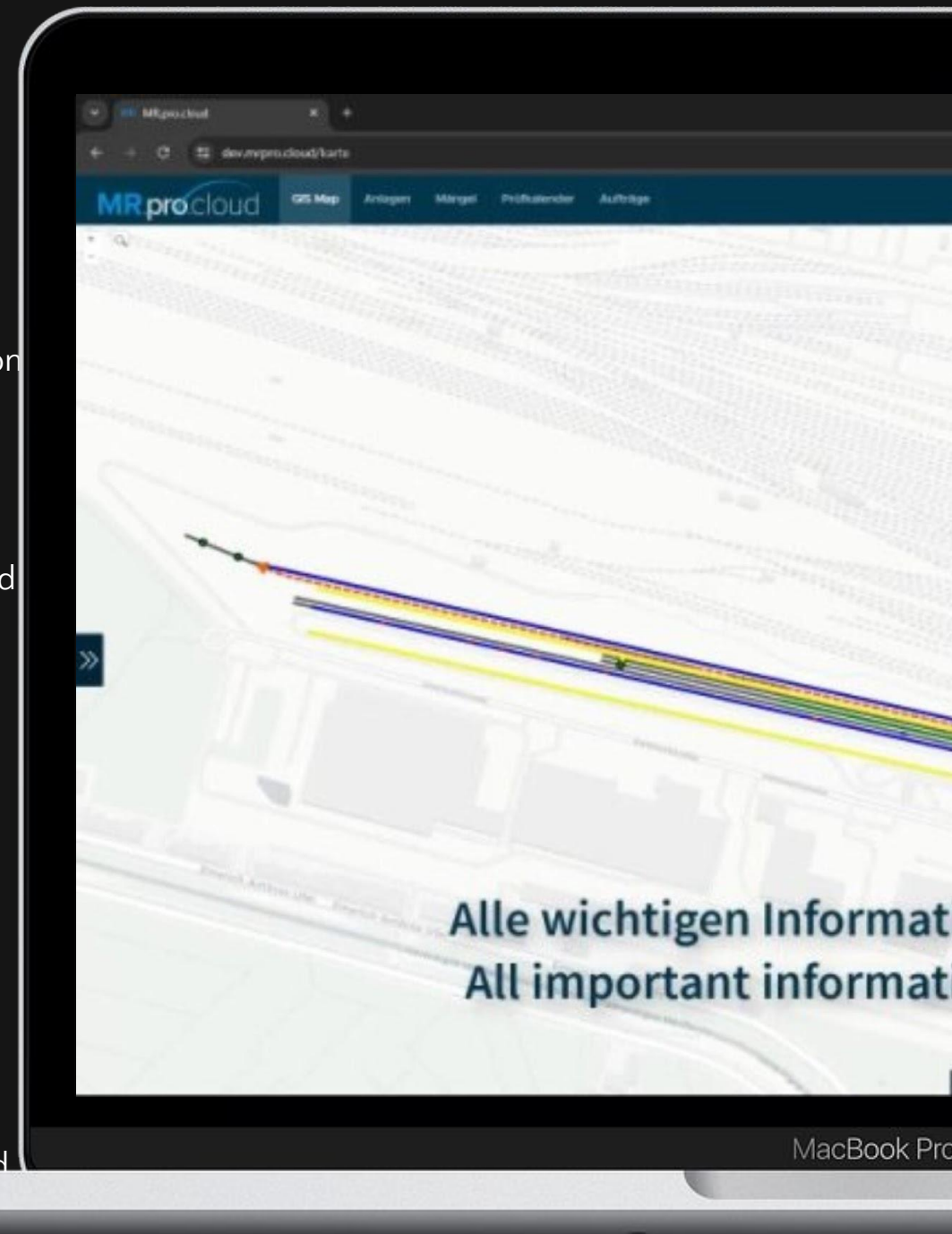


FEATURES

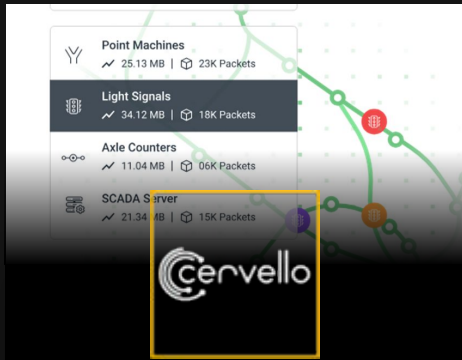
- / Track, switches & crossings, other assets as like traction power supply, catenary, signalling, stops, real estates and supporting structures are supported in a uniform and comprehensible layout.
- / Measures and visual inspection results are transformed digital in one common database
- / Order processing and work completion follow up
- / Monitor of quality level with KAV (asset wear)
- / Budget planning based on actual conditions and gathered historical data

PRODUCT BENEFITS

- / Highest possible availability and safety of switch and track systems at an optimized budget
- / Development and implementation of a cost-optimised maintenance strategy based on targets



CERVELLO



CERVELLO

Cervello is the rail cybersecurity solution railway operators and infrastructure managers use to ensure safe and reliable transport.

SYSTRA



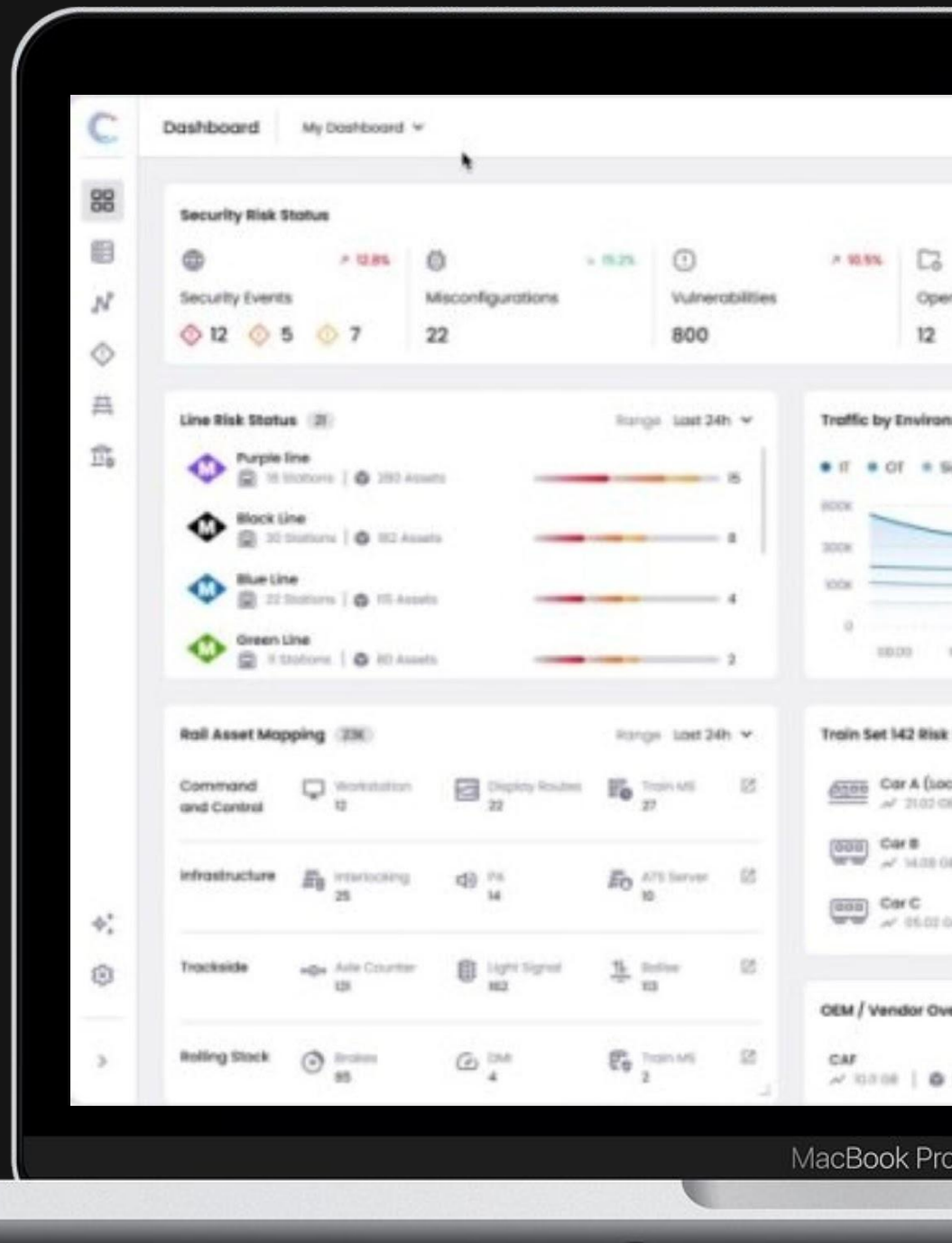
SBS Transit

FEATURES

- / Network Visibility
- / Asset Management
- / Vulnerability Management
- / Security Misconfigurations
- / Threat Detection
- / Investigation & Response
- / Risk Management & Reporting
- / Network Segmentation

PRODUCT BENEFITS

- / Identify all digital assets in your network and assess security level
- / Proactively manage risks by managing vulnerabilities and misconfiguration
- / Support investigation and response in case of critical



MacBook Pro

DATA LAB



DLB

The data lab is a data exploration solution leveraging the power of cloud computing. It serves at understanding track behavior and design algorithms for event detection

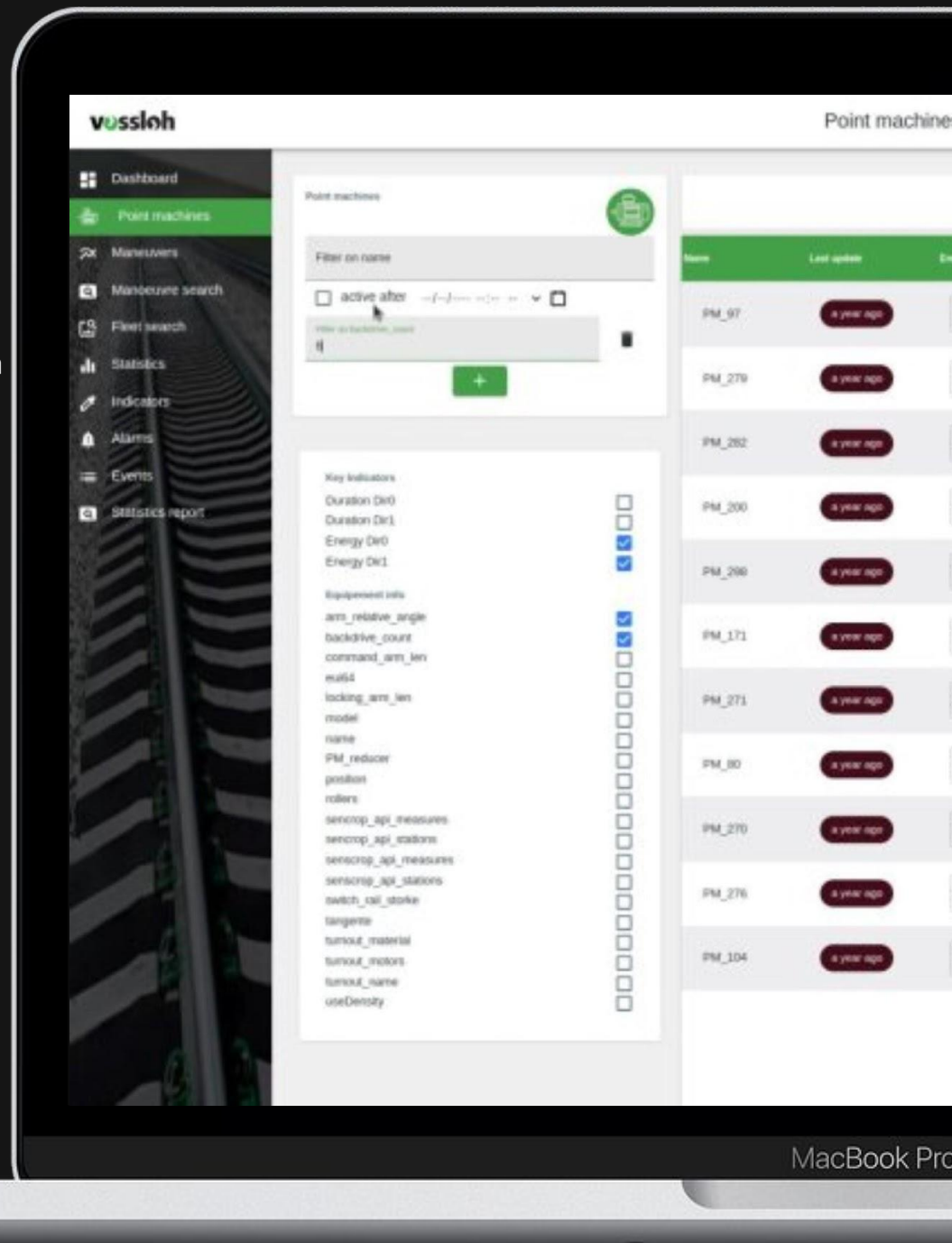


FEATURES

- / Data Visualization : facilitate the visualization of all data collected and to compare events
- / Create Statistical KPI, Alarms and events : It is possible to create KPI and alarms to
- / create simple or complex algorithms in python and test it right away on the data observed
- / Exchange : collaborate with a simple interface where one team member can highlight a signal or part of the signal and ask for support from other stakeholders

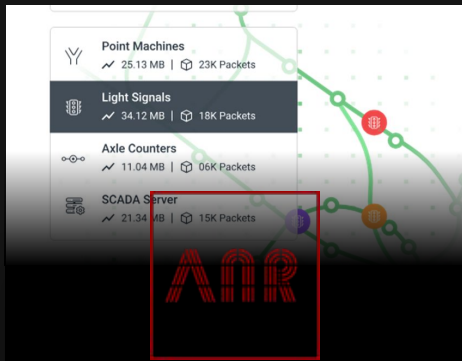
PRODUCT BENEFITS

- / One place for data exploration
- / Power of the cloud computation
- / All data sources



MacBook Pro

ANYR



ANY'R

ANYR is a solution to provide GSMR capabilities to a regular android phone at low cost.



FEATURES

- / Vossloh has developed an environment to communicate on GSM-R network using standard Android smartphones:
- / ANY'R gateway: a Bluetooth modem connecting any smartphone with GSM-R frequencies.
- / ANY'R APP: a communication interface providing all functionalities of safety railway phones.

PRODUCT BENEFITS

- / Easier procurement as GSMR for Off-the-shelf smartphones can now be connected to GSM-R.
- / Cost efficient as ANYR + an android phone is cheaper than a GSMR cellphone
- / User friendliness : user can have a state of the art android phone.



DIGITAL LOGISTIC PLANNER



DLP

The Digital logistic planner is a tool to improve track availability when replacing switches while mitigating risks (human, costs, delays)

FEATURES

- / Simulation of the turnout replacement operations.
- / Any source with sufficient information of the surroundings (point cloud, a BIM model etc.)
- / Experiment various logistics methods, time constraints, various methodology and time line.

PRODUCT BENEFITS

- / Reduced traffic downtime with shorter track closure
- / Improved efficiency of maintenance shifts
- / Improved safety on the construction site
- / Reduced overall risks (missing equipment, overshoot)

