

PANThealth

Keep the trains on track





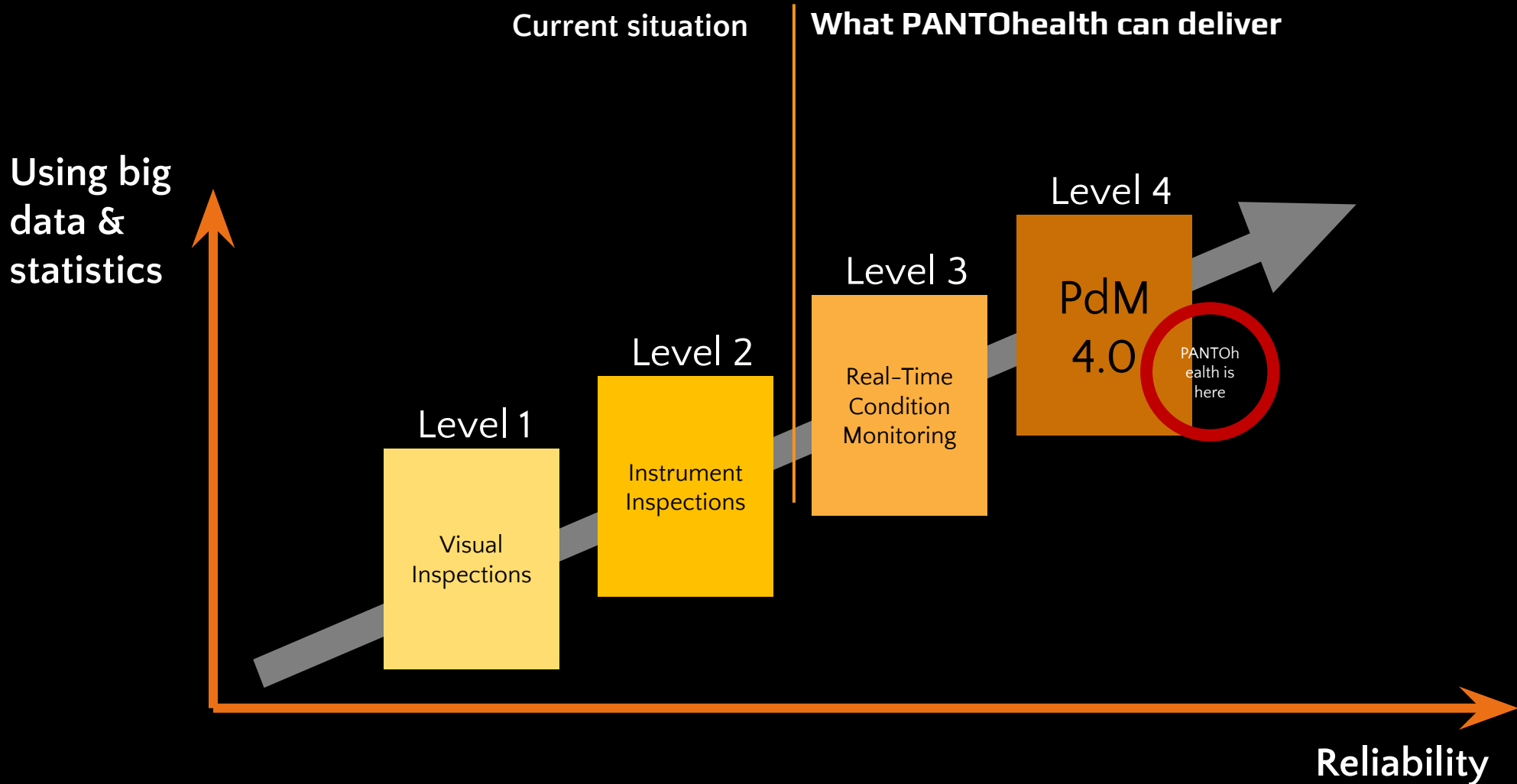
AI Filling in the Gap

AI is now able to fill in the gap between data collection and maintenance execution





Predictive maintenance maturity is the key.





We provide a **Solution** in 3 simple steps
Let's have a quick review

1

Gathering all data
from different
pipelines

User's current data
pipeline

PANTOhealth devices* - if
necessary

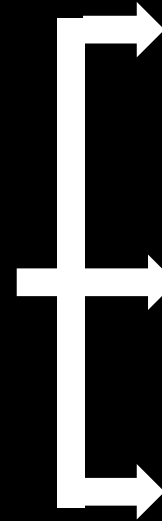
Generated data from
PANTOhealth simulation**



2

Analyzing data with
patented ML algorithm

Merging all data on one
dashboard, analyzing and
delivering on a live
monitoring dashboard***



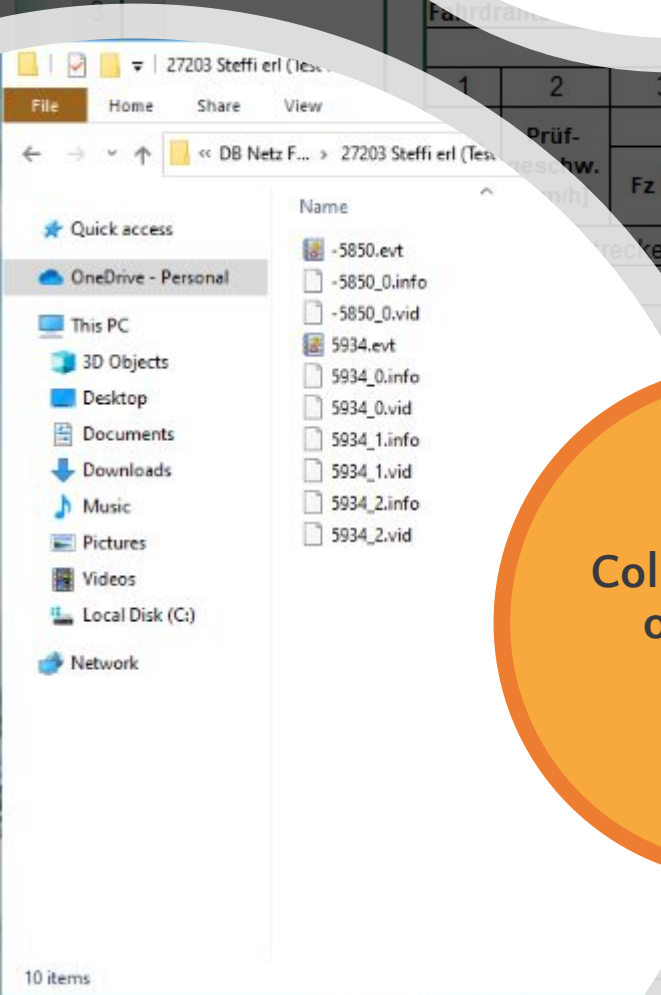
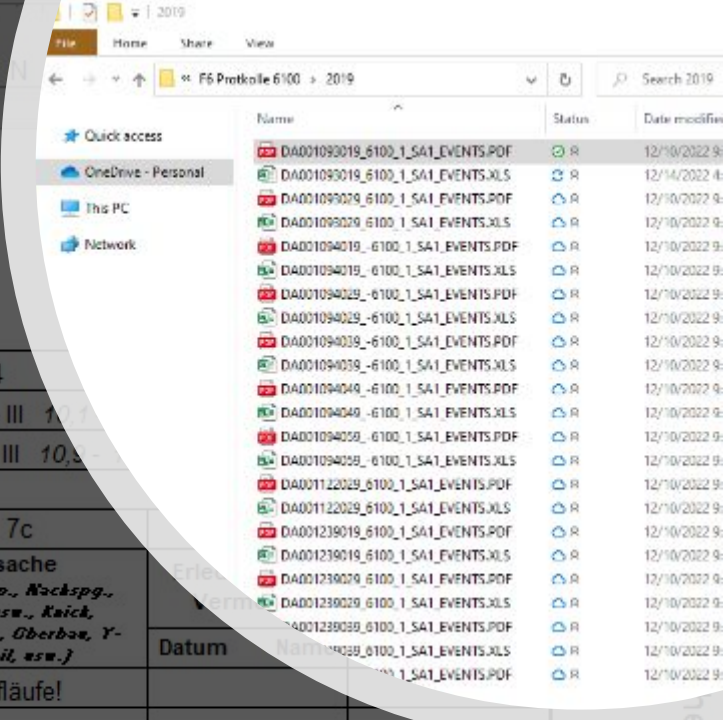
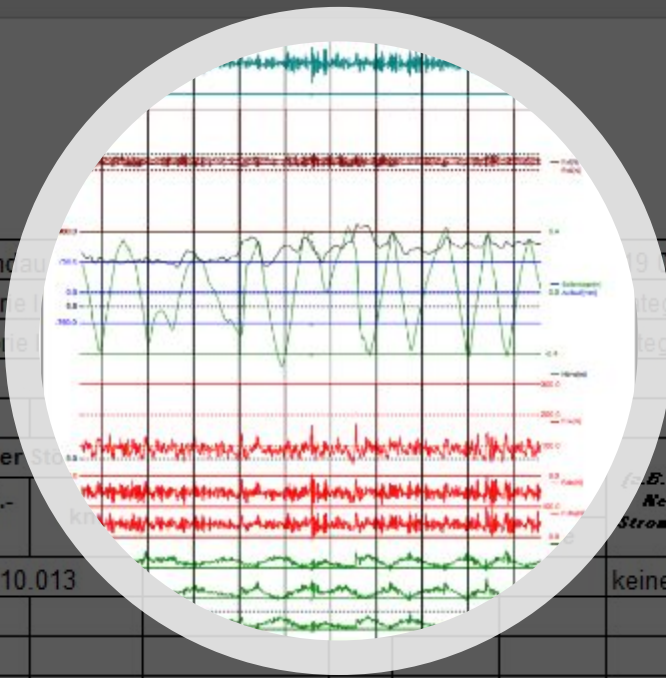
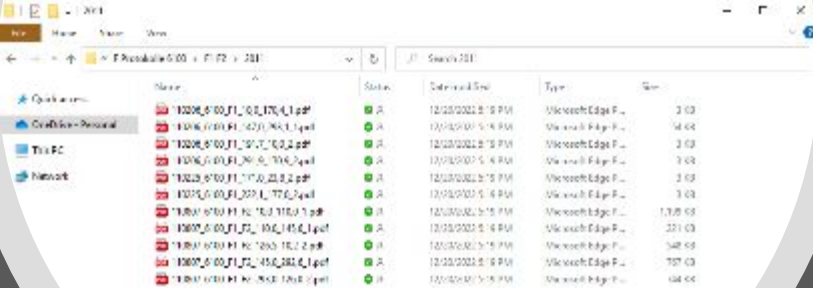
3

Making reliable answers
for main maintenance
questions

Where is the problem?

What to do to solve
the problem?

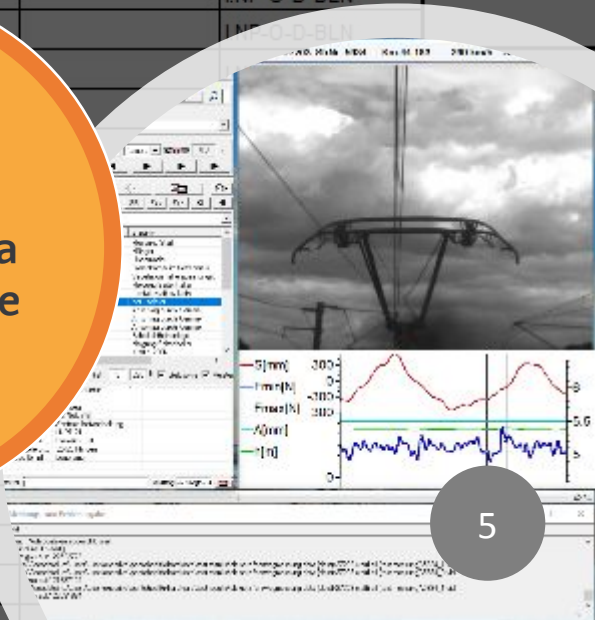
When is the best time to
do the maintenance?



Collecting data,
once per 6
month

Comparing with
thresholds and
defining
problematic
points

Dumping the
rest of the data
!in cold storage





Hardware

PANTOcase



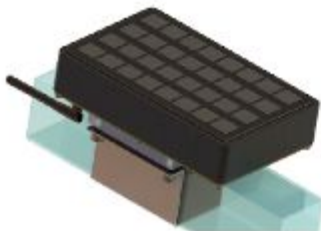
Mainboard processor for receive data from PANTOpack and send to th server which will be installed inside of train

PANTObase and laser



A case installed on the train's roof include camera, antenna and laser(optional) .

PANTObank



The data acquisition board over the pantograph frame which collects data from the PANTOsens and sends to PANTOcam

PANTOpack and reciver



The data acquisition board with acc sensors of the PANTOsystem which are installing on the pantograph head

*Patented
modular IoT
Devices*

Option 1

× × ✓



Option 2

✓ ✓ ✓



Option 3

✓ ✓with laser ×



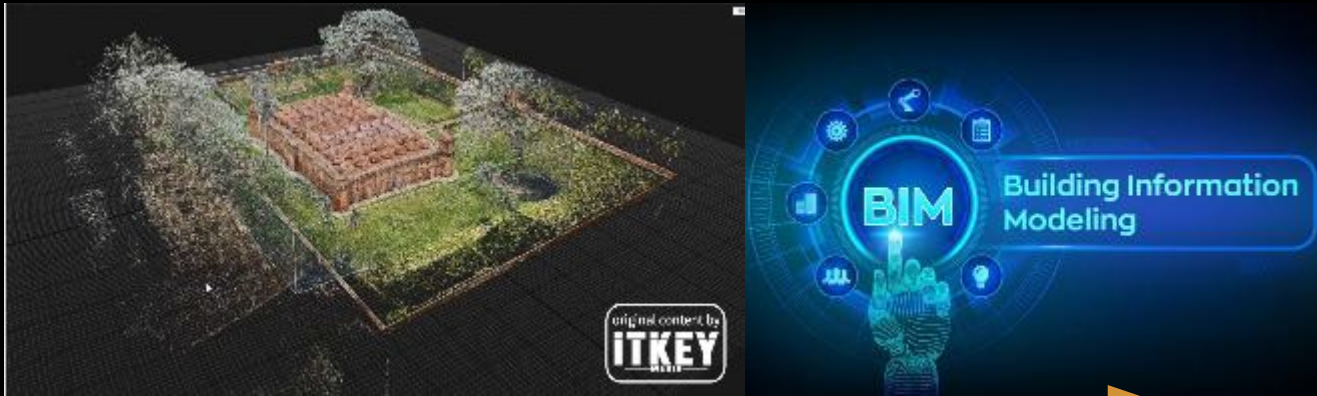
Option 4

✓ ✓with laser ✓





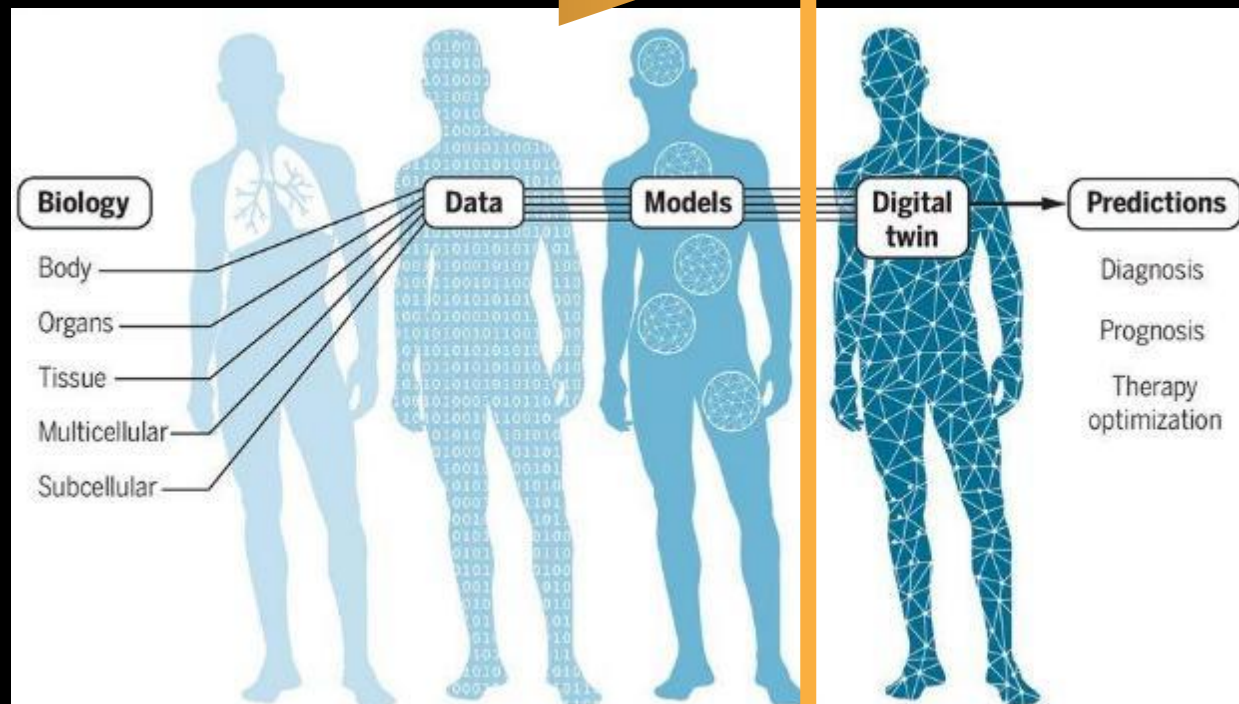
Digital twin, body and soul



Reality capturing / BIM



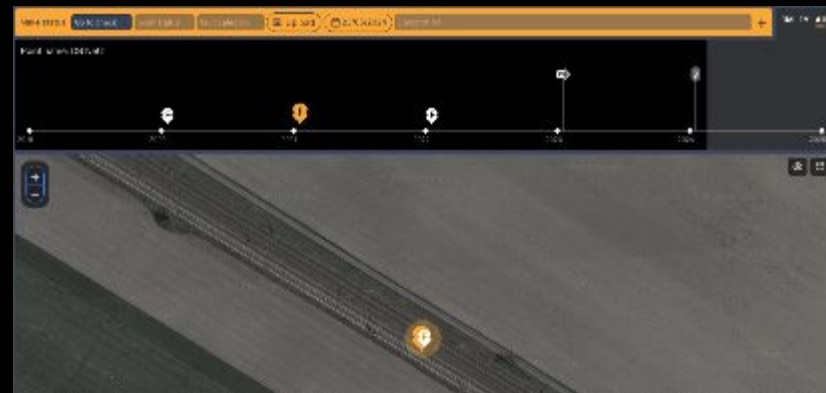
Mathematical model (Analytical/FEM)



Example 1: dropper installation

Example 2: Neutral section in Denmark

Example 3: the best location for installing sensors



Problem
identification

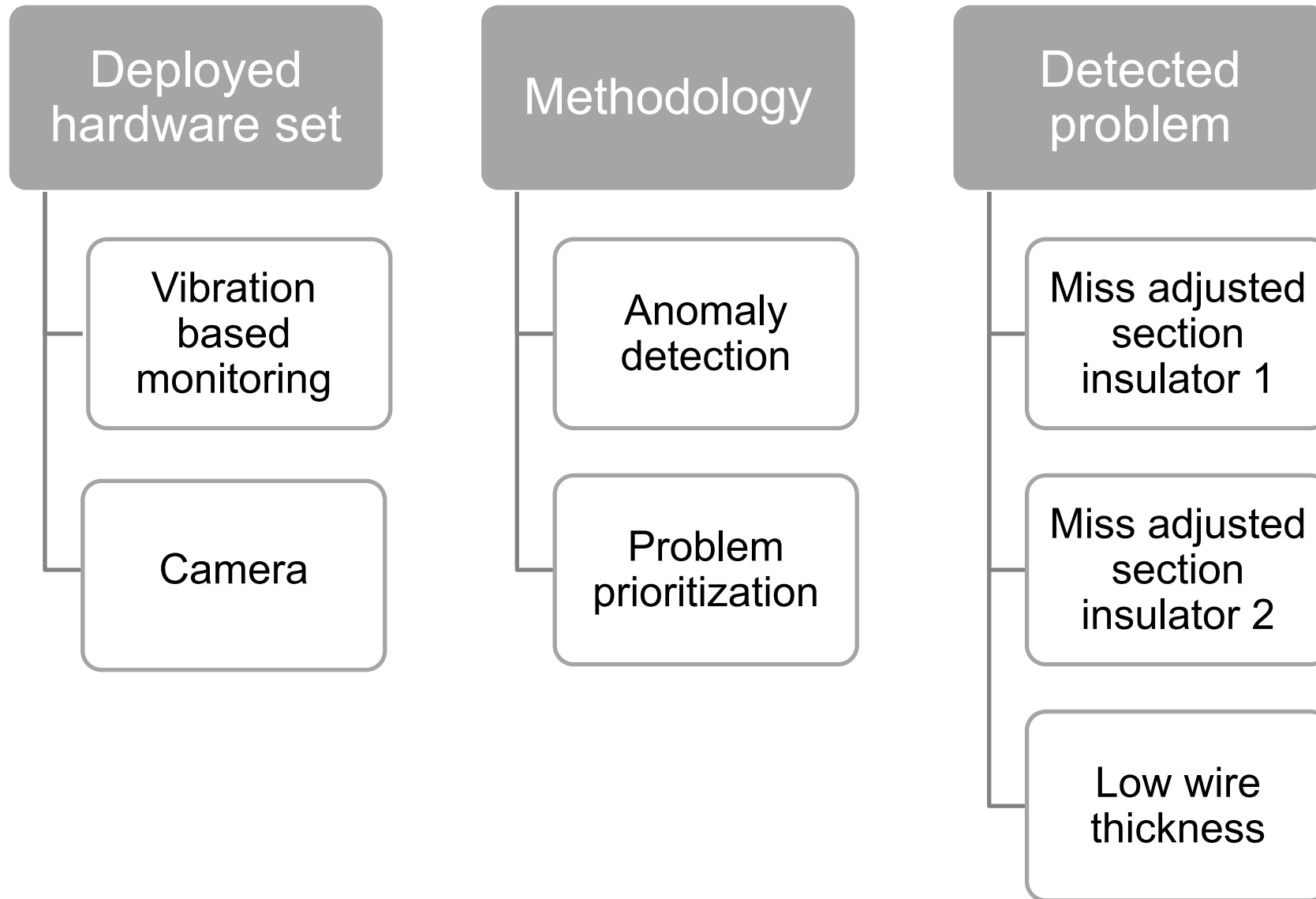
Monitoring
and exploring
trends

Maintenance
task management
& feedback



Field Results
Short version

Field Inspection





Sensor implementation and data acquisition for overhead lines



Accelerometer



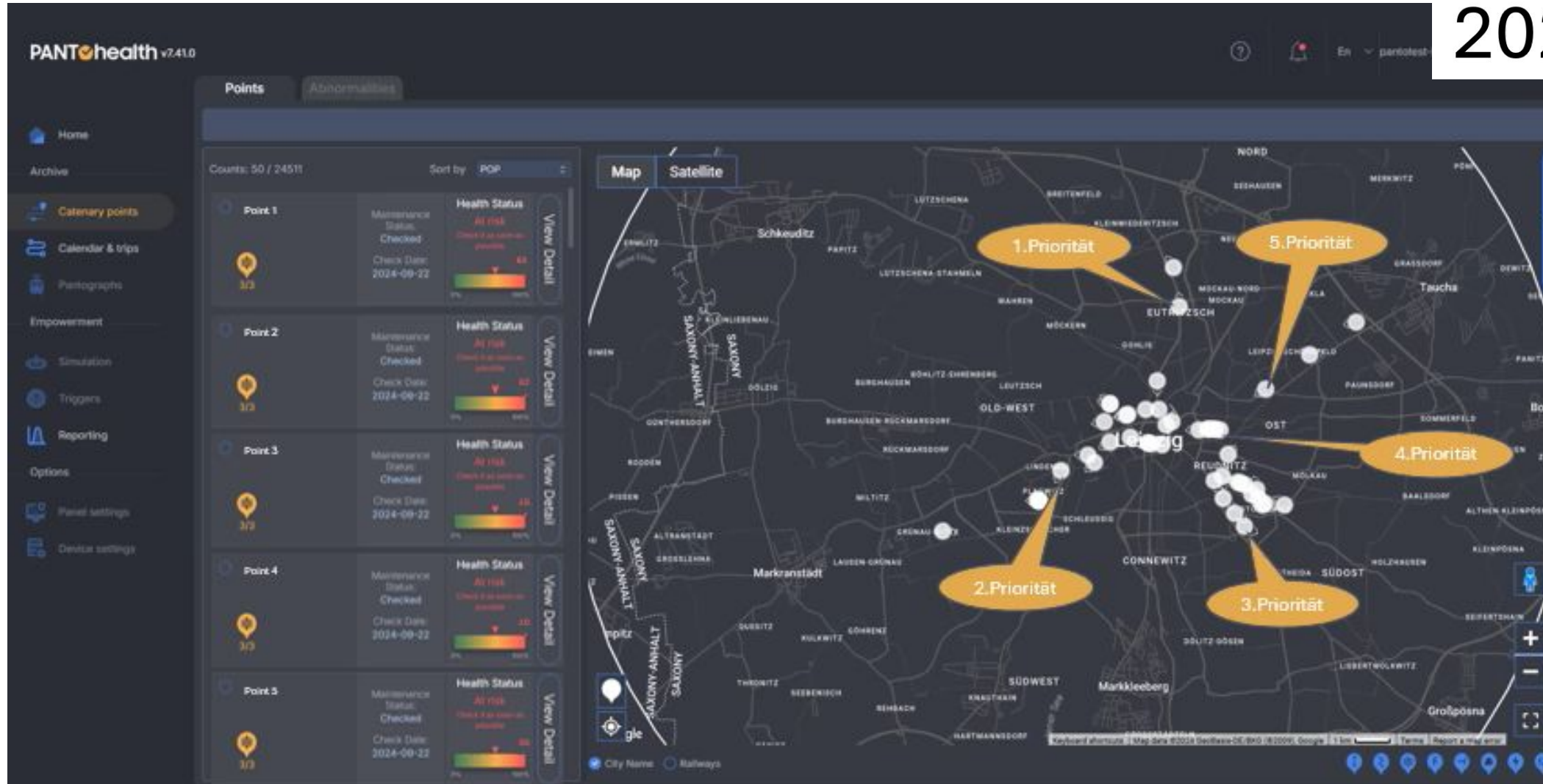
Camera





health index of each point and maintenance prioritization

2024-08-25





1. Miss adjusted section insulator 1



A misadjusted section insulator was identified as a **recurring source of mechanical shock** to every passing pantograph.

Vibration-based signal analysis revealed consistent anomalies at the same location.

Visual footage supported the analysis, showing **consistent sparking as pantographs crossed the insulator**.

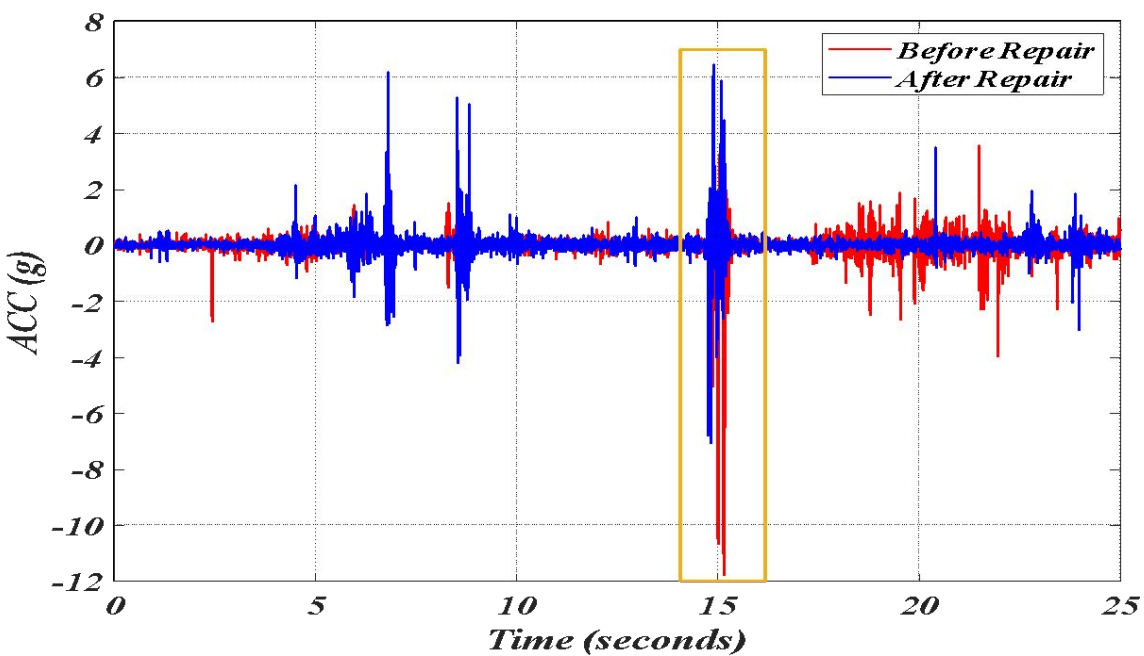




Effect of a simple adjustment

Following a targeted field inspection, the reason was traced to a **simple cable misalignment**. The adjustment required less than two minutes of manual intervention.

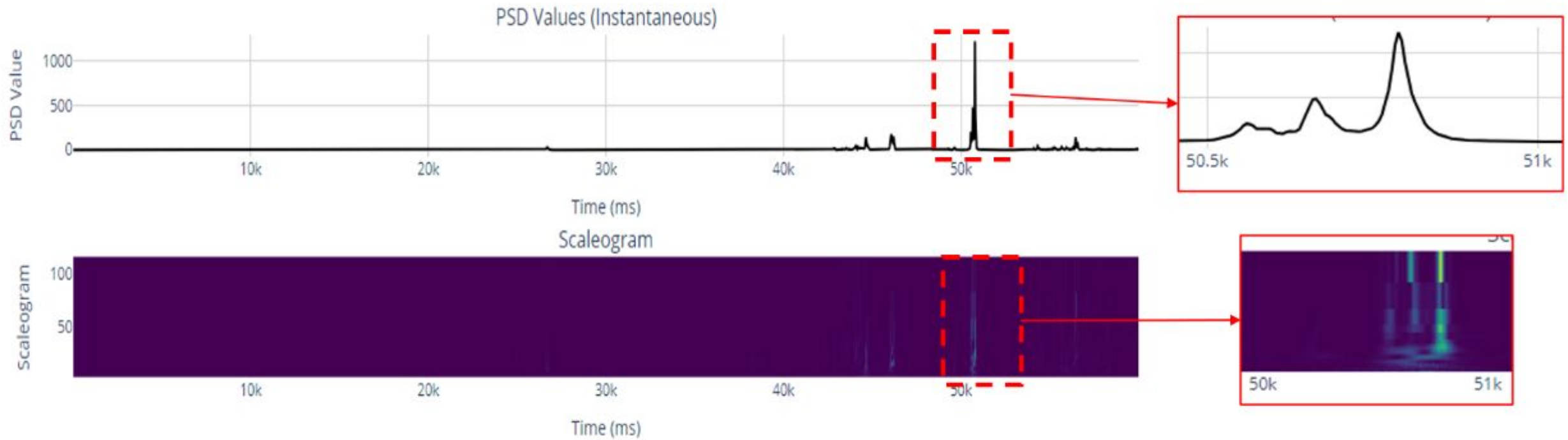
Subsequent monitoring showed a marked **improvement in signal stability**, highlighting the value of real-time abnormality detection and prioritization in preventing progressive damage to the pantograph and catenary infrastructure.



Features/Merkmale%	Before Repair	After Repair	Improvement (%)
	/Vor der Reparatur	/ Nach der Reparatur	/ Verbesserung (%)
STD	1.55	1.36	12.2
Peak	11.25	5.61	50.1
PSD	508.87	187.85	63.1
Speed	38.13	36.32	0.05
Score	90	84	6.6

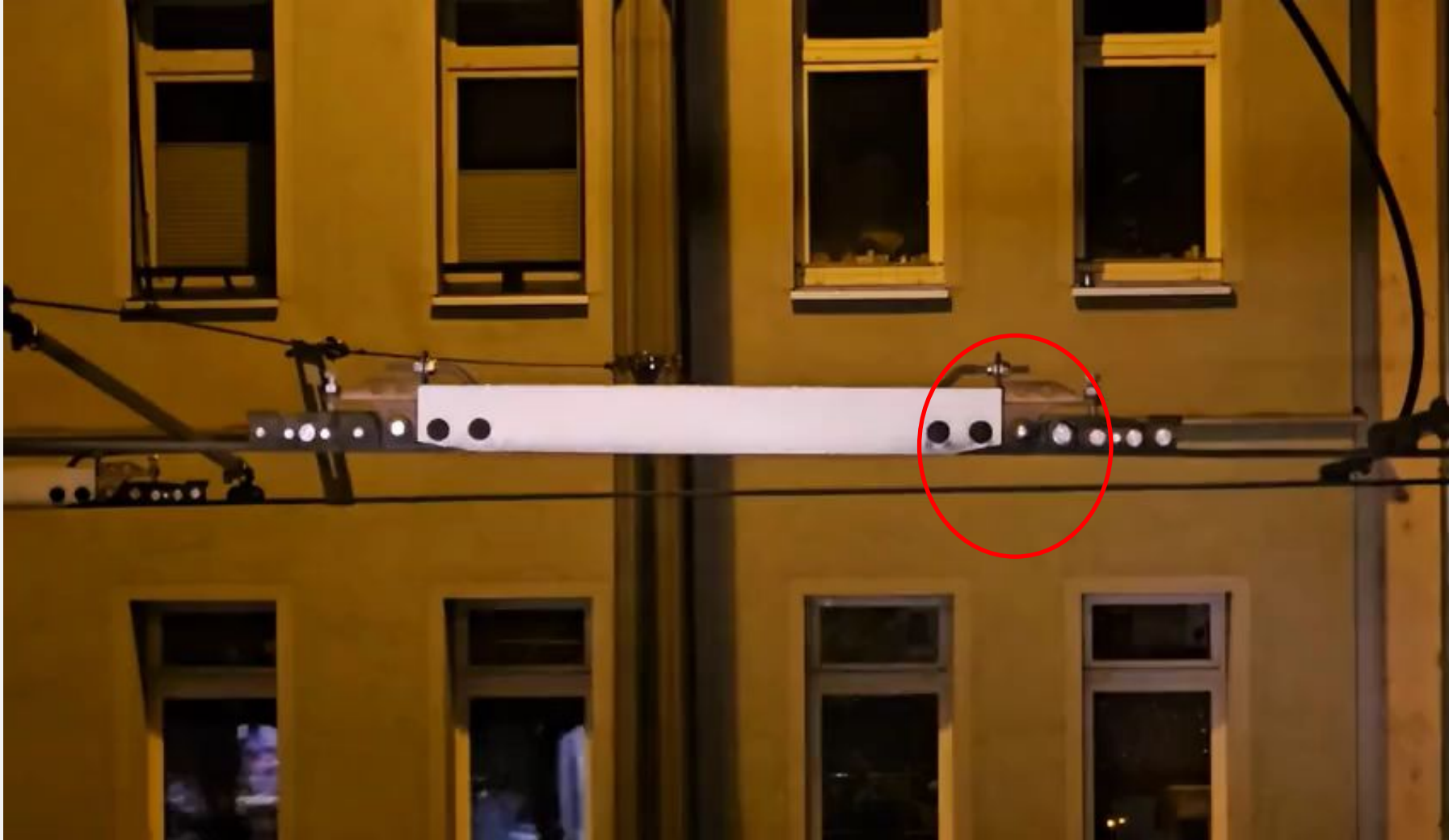


2. Miss adjusted section insulator 2





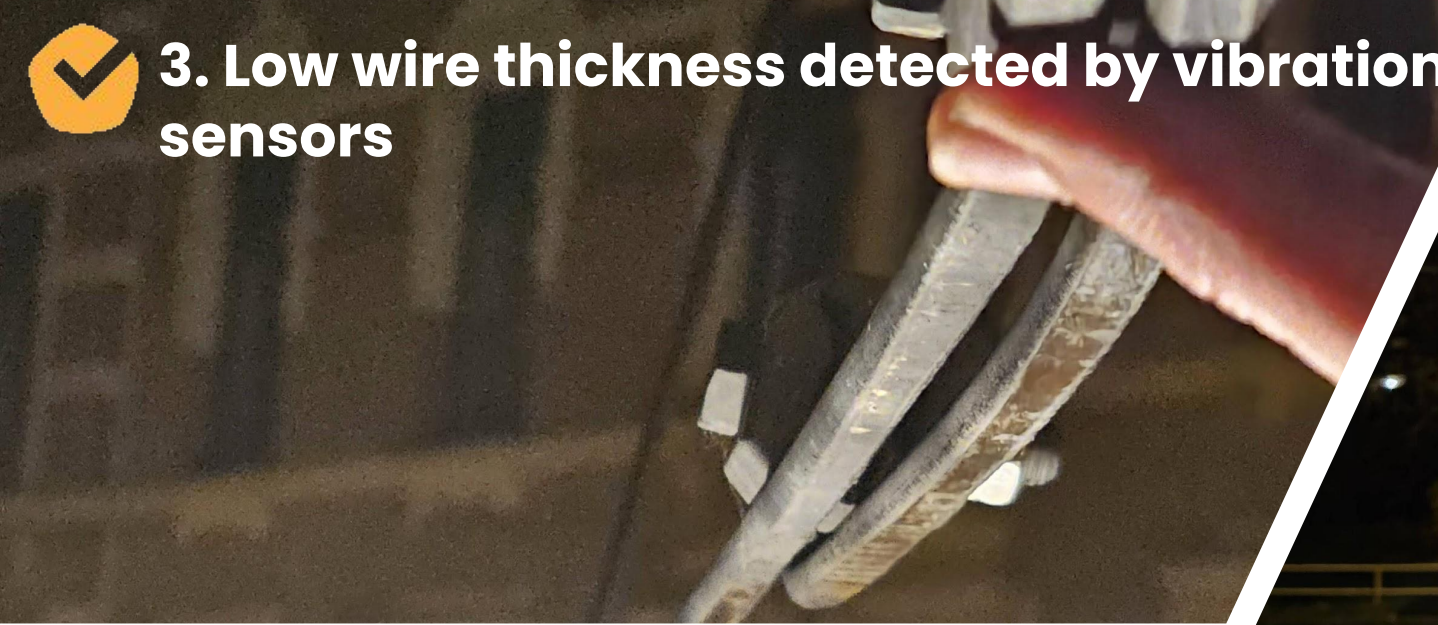
Miss adjusted section insulator hits pantograph



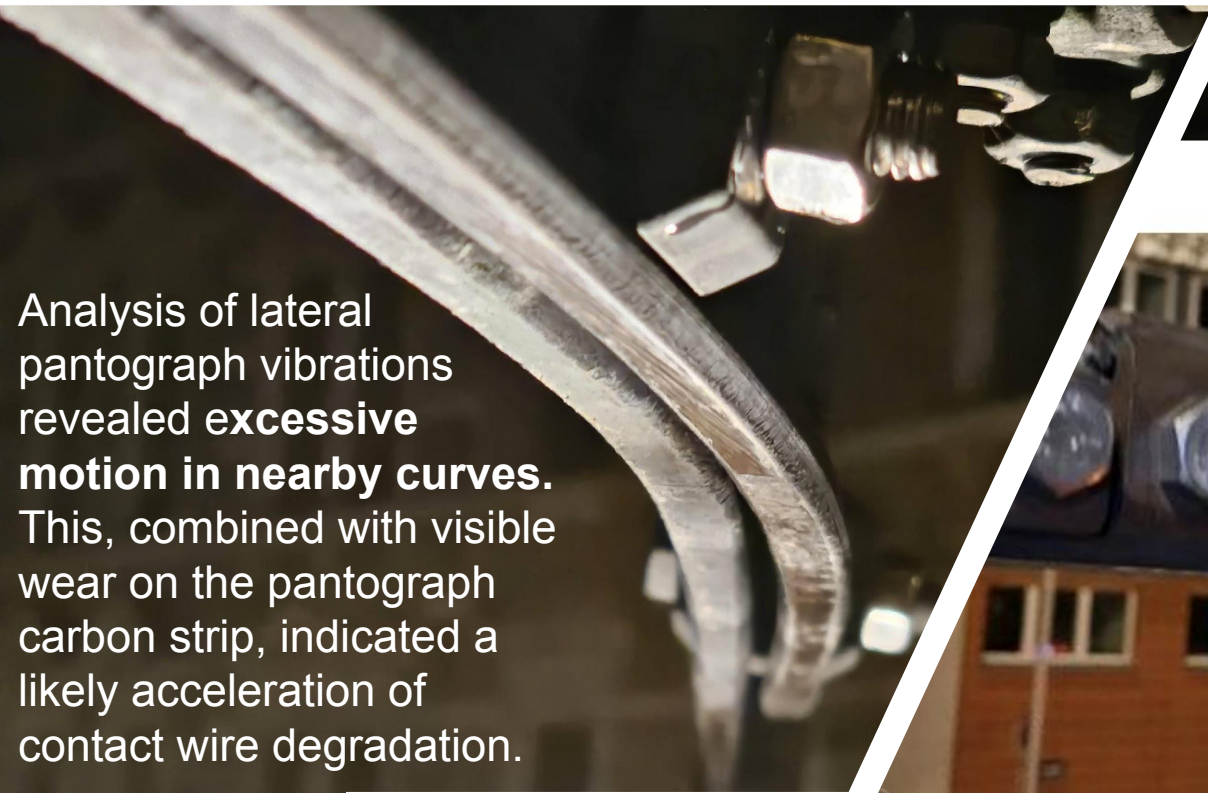
A second misadjusted section insulator exhibited an imbalanced dynamic response, with a **smooth entry and a pronounced shock at the exit.**

The corresponding video footage captured **sparking at the exit, providing clear visual evidence of the disturbance.**

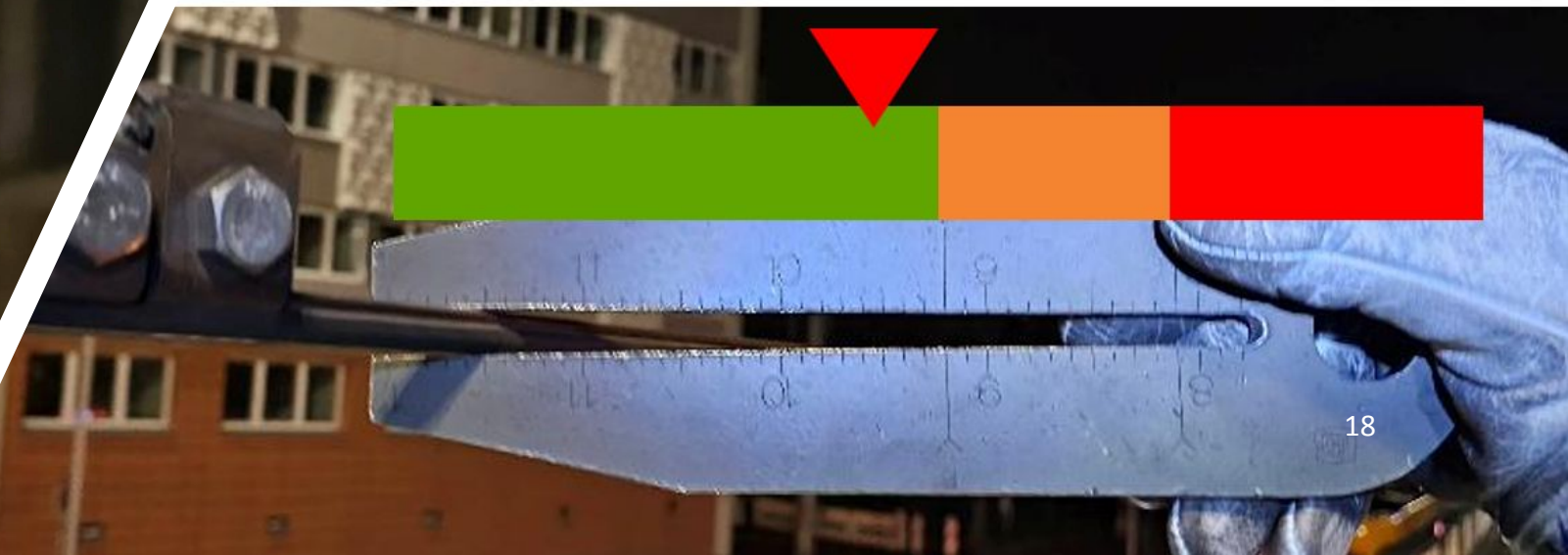
 3. Low wire thickness detected by vibration sensors



Detected low thickness



Analysis of lateral pantograph vibrations revealed **excessive motion in nearby curves**. This, combined with visible wear on the pantograph carbon strip, indicated a likely acceleration of contact wire degradation.





Root Cause Analysis: Pantograph and Catenary Wear Progression

Step 1: Hard point or irregularity in line

- **Example:** misadjusted section insulator



Step 2: Create damage or roughness in carbon strip

- **Example:** a notch in the pantograph



Step 3: increase wear rate in contact wire

- **Example:** low thickness in contact wire at curves



Step 4:
contact wire failure





Root Cause Analysis: Pantograph and Catenary Wear Progression



Step 1: Hard point or irregularity in line

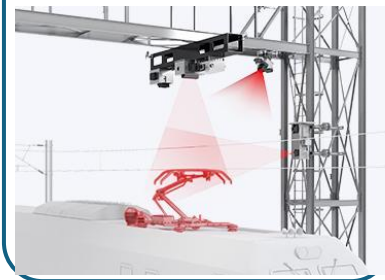
• **How to detect:**
vibration-based monitoring



PANTOhealth
vibration-based
monitoring

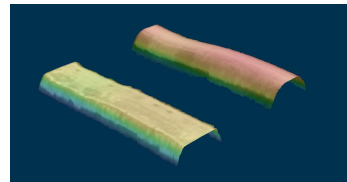
Step 2: Create damage or roughness in carbon strip

• **How to detect:**
wayside monitoring



Step 3: increase wear rate in contact wire

• **How to detect:**
Thickness measurement system



PANTOhealth
Profiling-based
monitoring

Step 4:
contact wire failure



No need to monitor,
people let you know!



The reliable partner for predicting
maintenance activities in the rail industry.



pantohealth.com



mahya@pantohealth.com



linkedin.com/company/pantohealth/