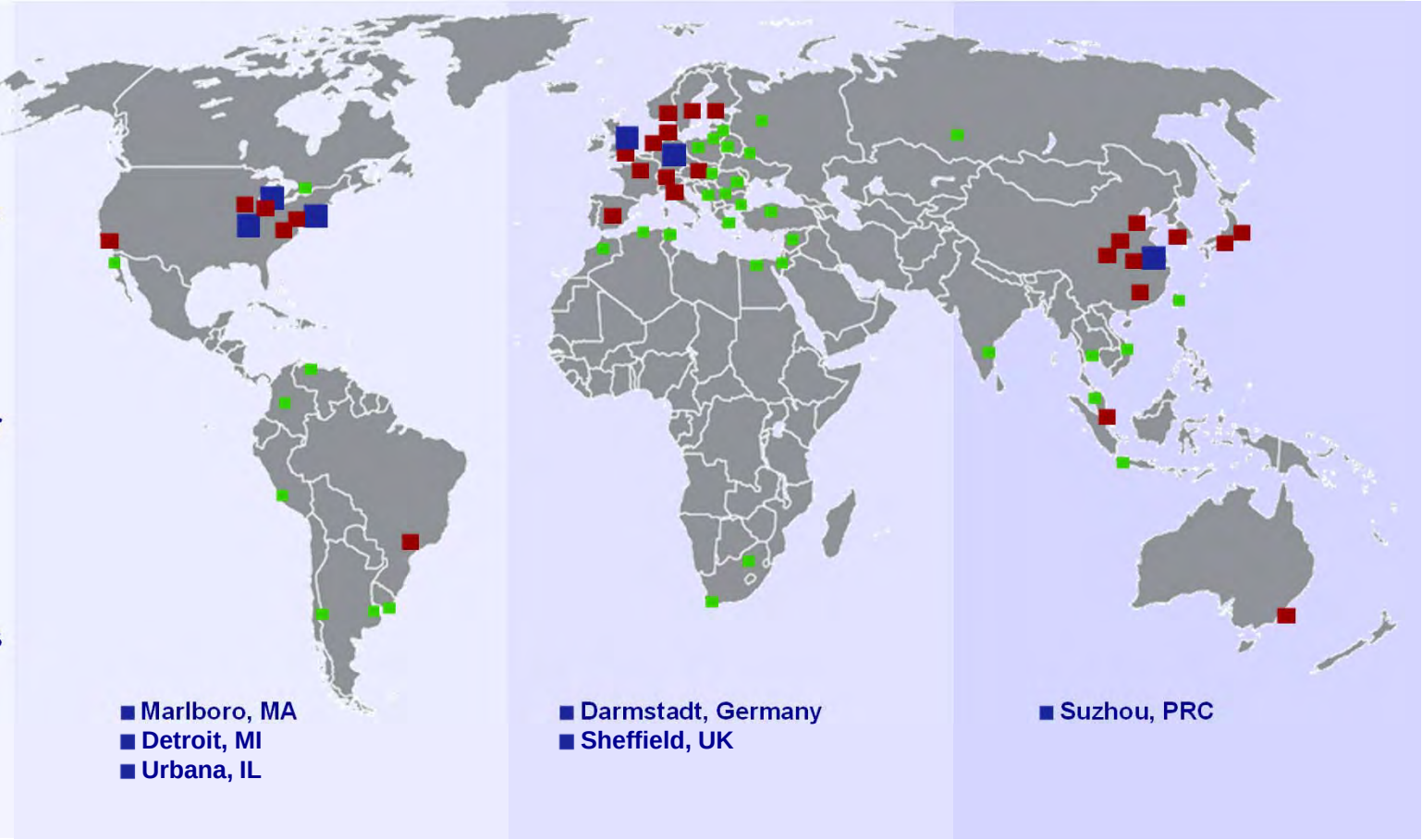
ARGOS® – a high accurate wayside train monitoring system

Walter.Weilinger@hbm.com

Hottinger Baldwin Messtechnik - the Global Market Leader

- 60 years experience
- 1,700 employees
- 6 engineering sites
- 26 sales locations
- Represented in over 50 countries by 33 independent distributors
- 140 developers
- Over 4,000 products



Competence from Physical Measurement to Virtual Testing

Projects Services Calibration

Sensors

DAQ Hardware

DAQ Software

Analysis & Data Processing

Simulation and Prediction

Typical HBM railway applications

railway applications

vehicle (MDA)

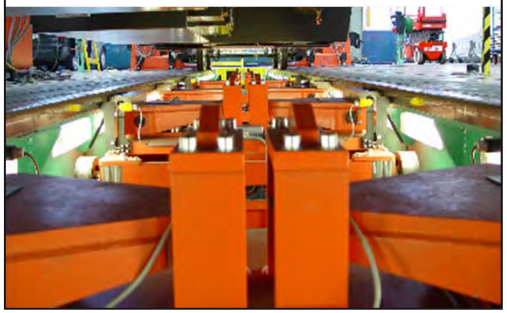
Vehicle certification

infrastructure measurement

Argos® systems

- **Argos® System**
- **Asset health monitoring (especially bridges)**
- **R&D infrastructure components (e.g. switches)**

test bench



mobile

stationary

Argos® – a high accuarate measurement solution

1998: initial research started and driven by ÖBB

2006: out of the box modular standardised solution

Argos® systems

Reasons for “wayside anti-derailment devices”

SAFETY:

Prevent accident

Hot Box detection
Bearing and Break

Derailment detection
Arglos® Level 1

Fire detection
Train gauge
Monitoring

Over loading,
Unbalanced load,
Instability
Argos® Level 2 & 3

Sensors are connected with the signaling system: Alarms stop the train!

Reasons for wayside train monitoring systems

Economical

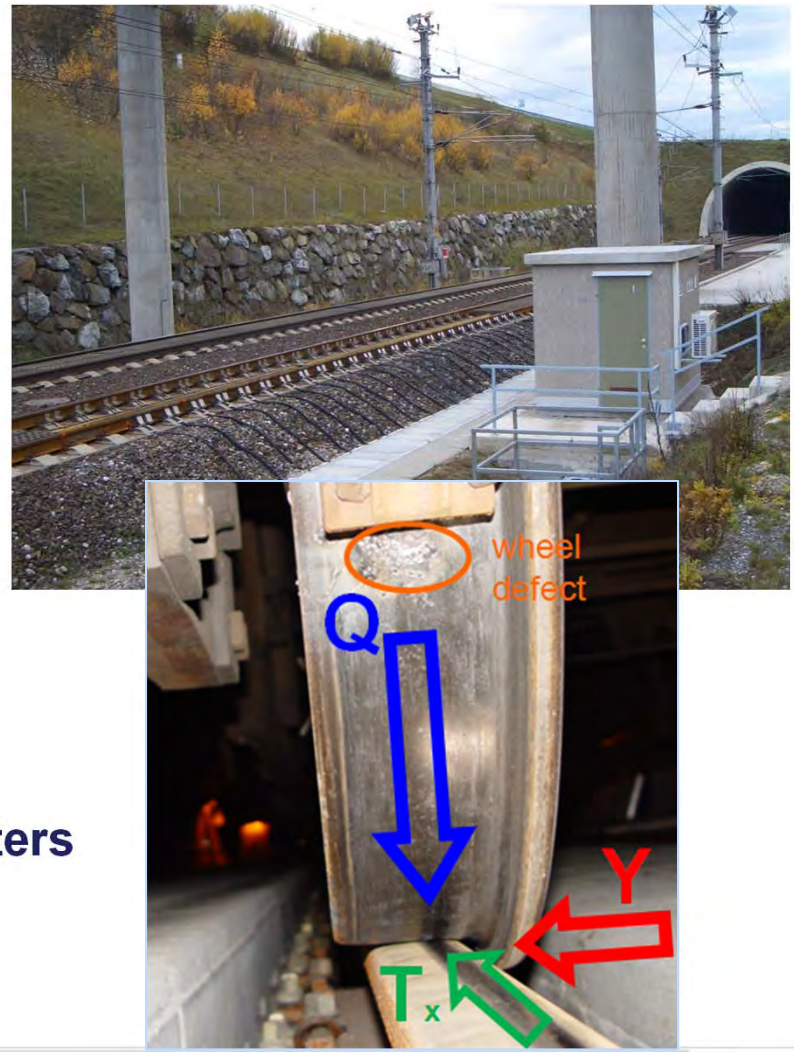
Enhancement of vehicle durability

Cost optimization and infrastructure protection

Permanent, centralized rolling stock monitoring and technical traffic check prevention

Argos® measured wheel-rail parameters

- Quasi-stationary vertical forces and loads (Q)
- Dynamic vertical forces and loads
- (derived quantities like axle side to side difference etc.)
- Quasi-stationary lateral forces and loads (Y)
- Dynamic lateral forces and loads
- Quasi-stationary longitudinal force (T)
- Wheel out-of-roundness



= all rail-wheel force parameters

The Argos® approach

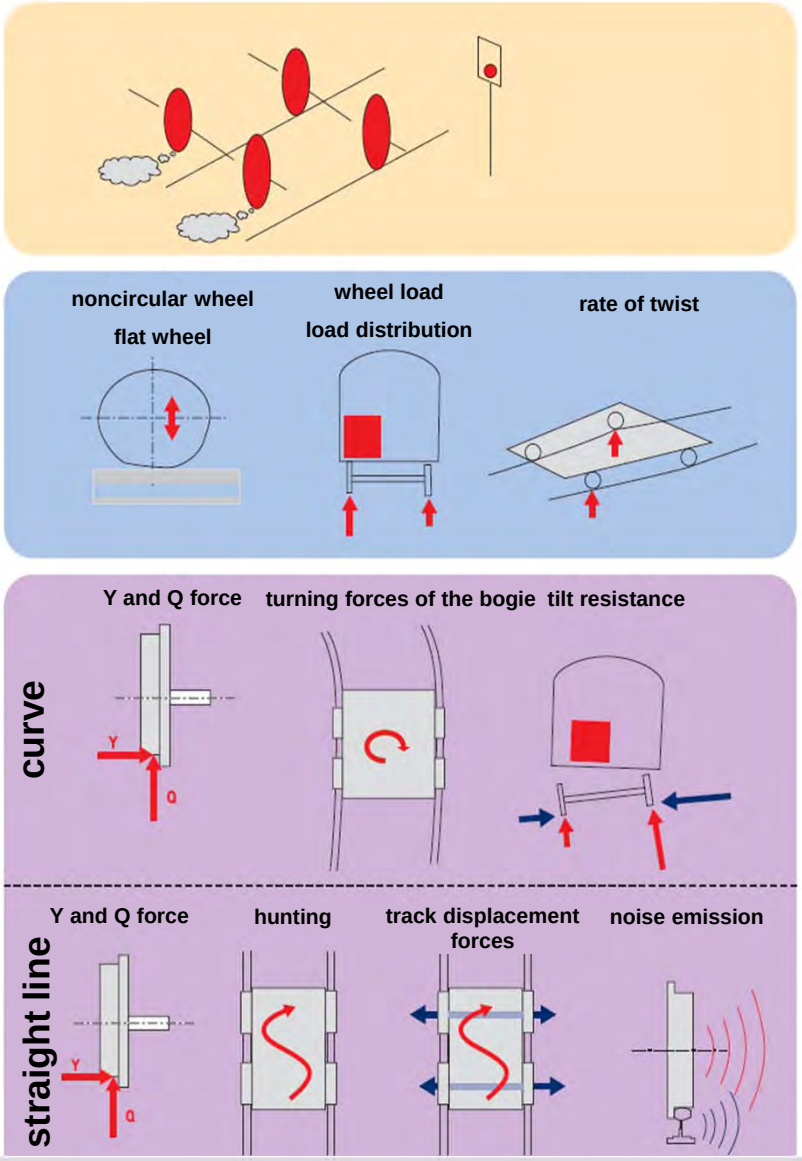
- Sensors integrated in the infrastructure
- Mounting on all track types possible
- No influence on the track maintenance
- Measurements on regular track speed (typical 20 up to 300 km/h)
- Best possible accuracy (better 1,5% on track speed)
- Near real-time measurement results (typical less than 5s)
- No vehicle type limits
- No sensors on the vehicle are necessary (but possible e.g. RFID-Tags)

The Argos® approach

Level 1 –
Derailment detection

Level 2 –
straight line train control

Level 3 –
train control and derailment safety



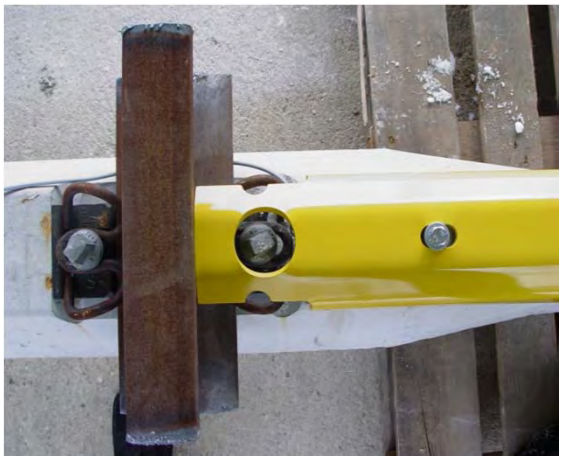
after derailment

risk and cost reduction

Prevention

Cost reduction

Argos® Level 1- Derailment Detection



Features Level 1

1. Simple princip, well developed technology
2. For all types of concrete, wooden sleepers
3. Easy mounting
4. All rail mounting elements are free visible
5. All derailment situations to be detected
6. No influence on track maintenance

Argos® Level 2 - Automatic Train Control

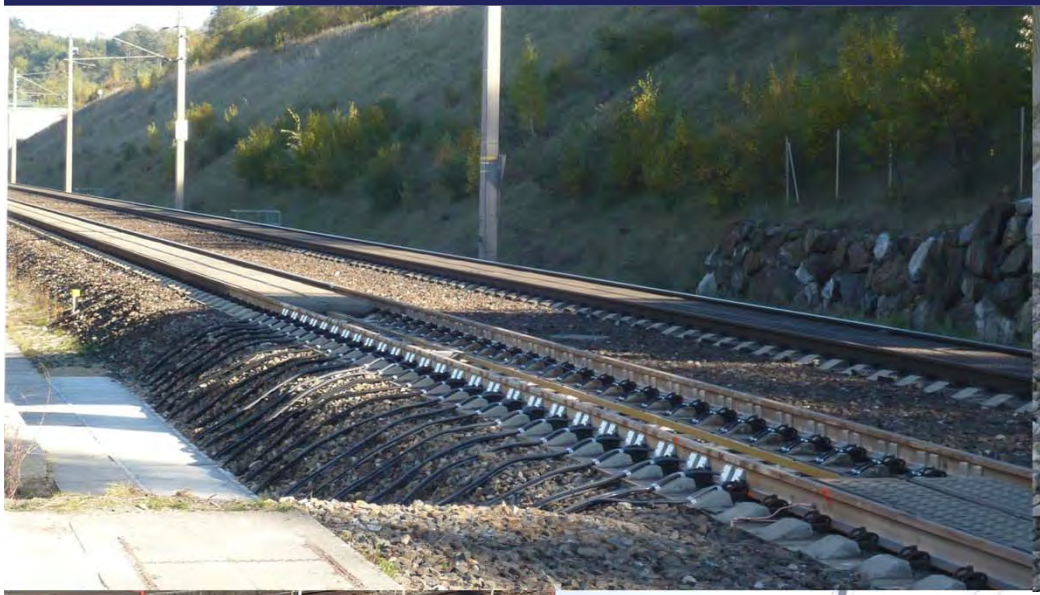
Detection of risk factors caused by:

- Wheel load (force) variations
- Wheel defects

Sensors taking over responsibility

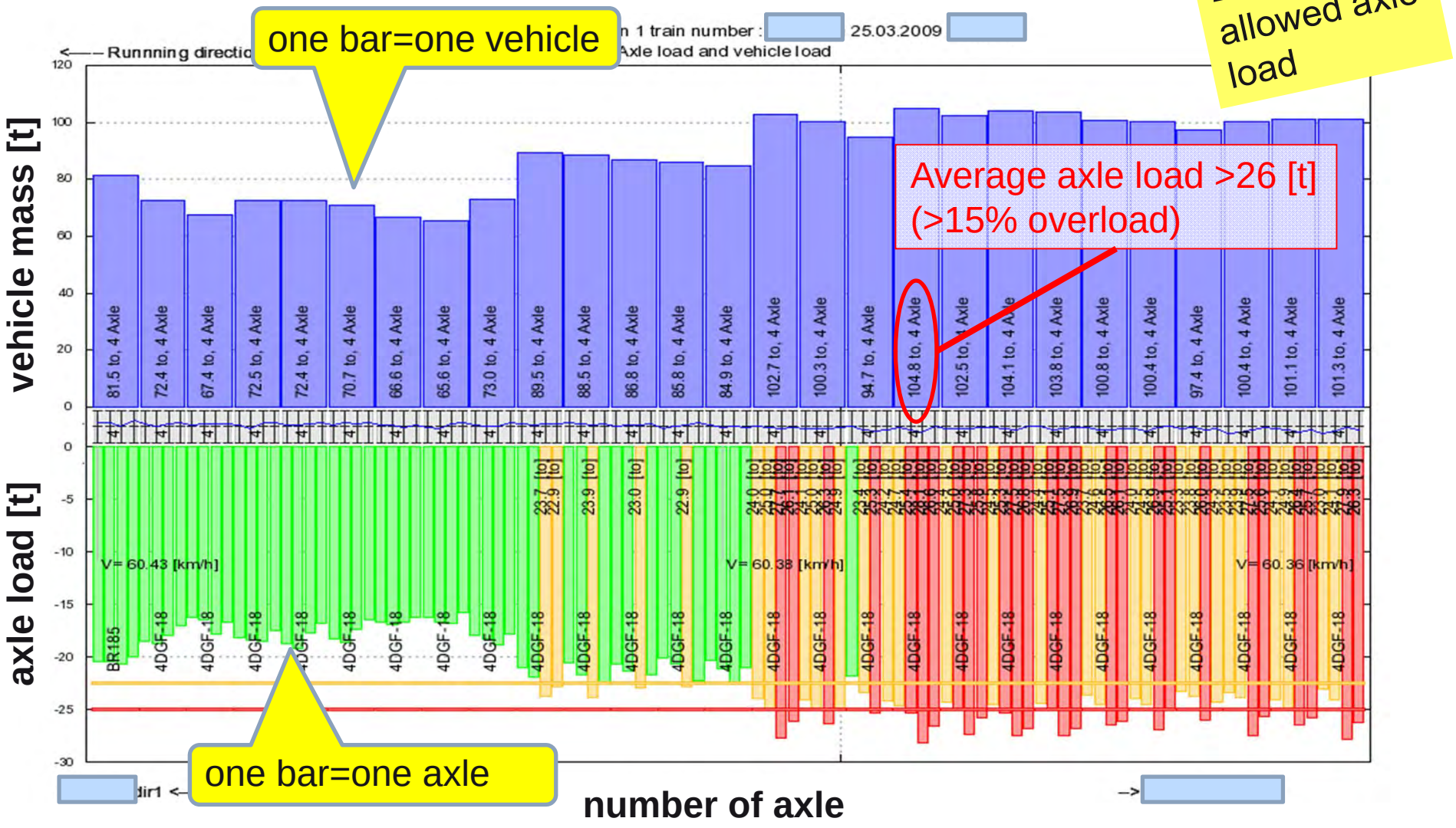
Argos® Level 2 - Examples

Argos® Level 2 - Examples



Argos® Installation with machine support

Argos® Quasi-stationary vehicle over loadings



What accuracy do we need?

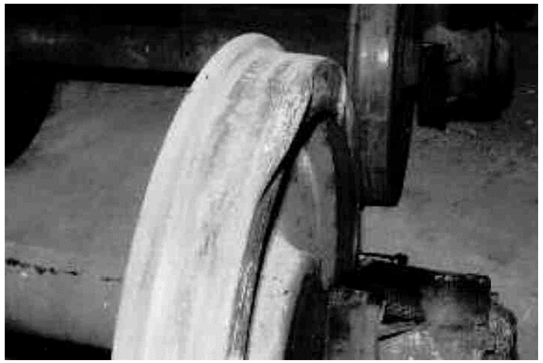
Example old Brigde in Austria: Max allowed axle load is 25t (strict limit)

Allowed axle load on the track 22,5t

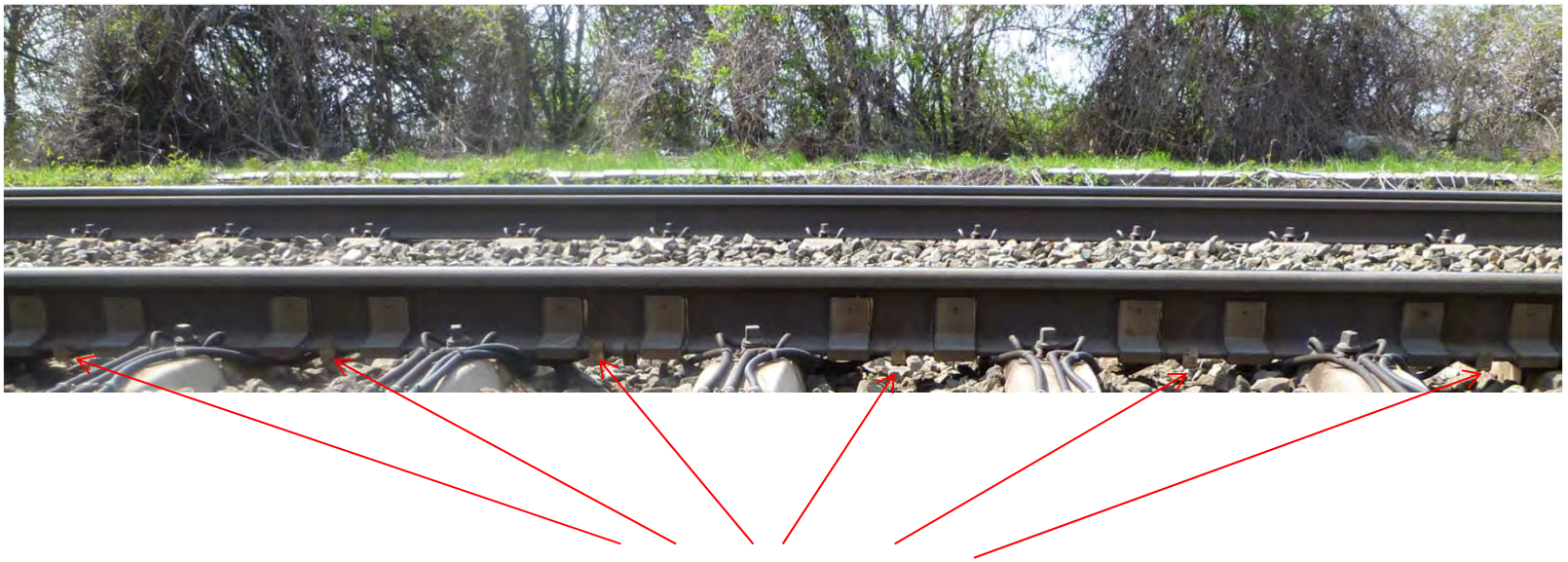
Measured with +/- 10% accuracy class
Vehicles with 22,75t axle load have to stopped
This is not practicable

Measured with +/- 1,5% accuracy class
Vehicles with 24,62t axle load have be stopped
This is practicable!

Wheel defects



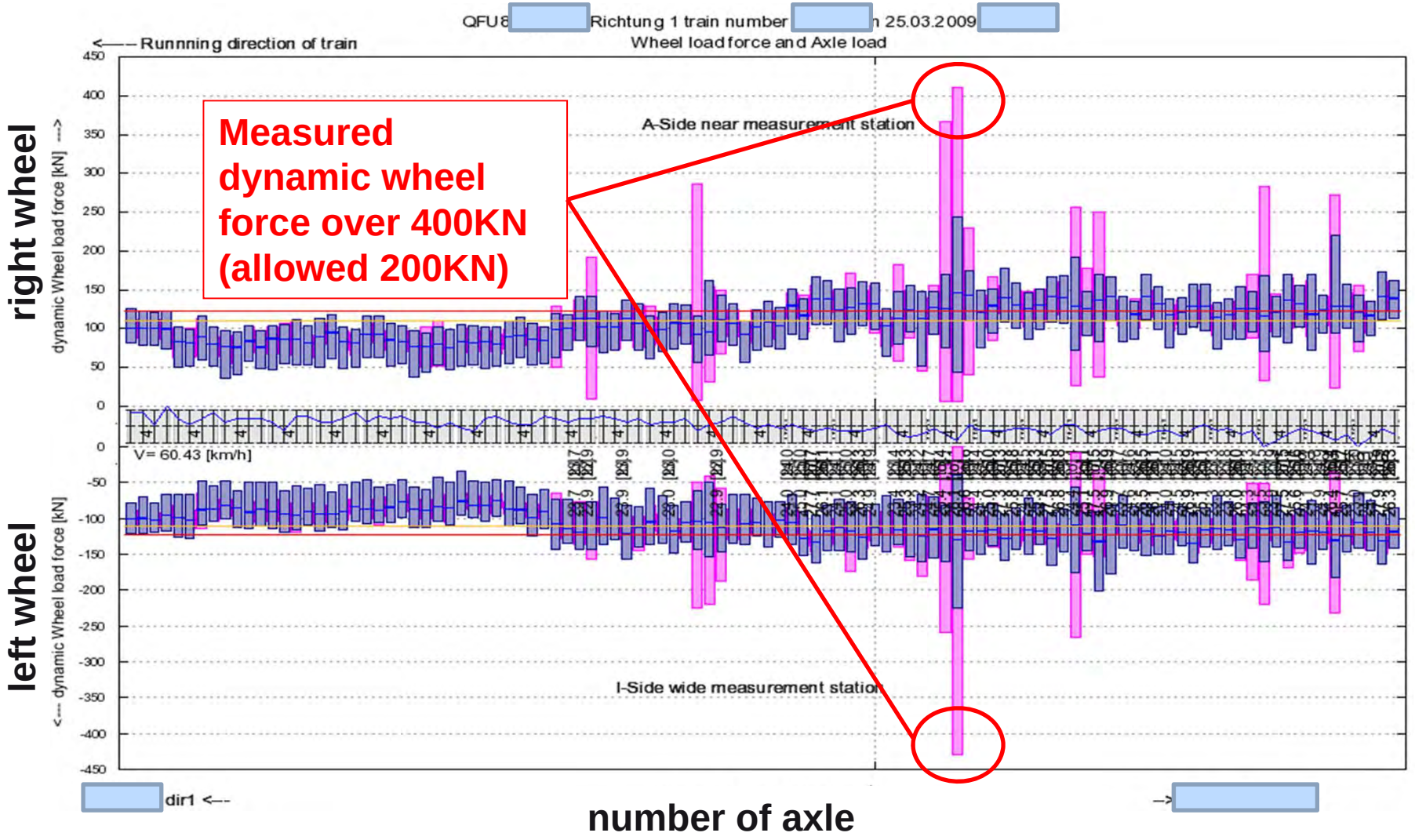
Argos® Modul „wheel shape irregularities“ measurement principle



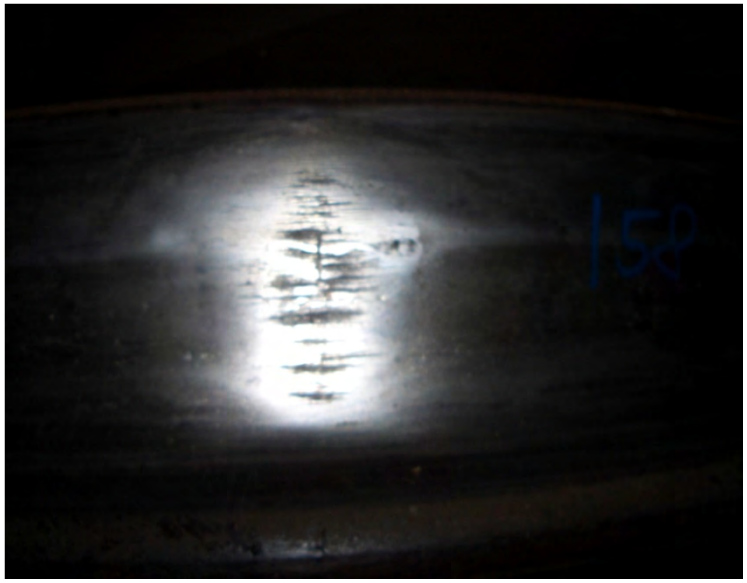
special engineered accelerometers

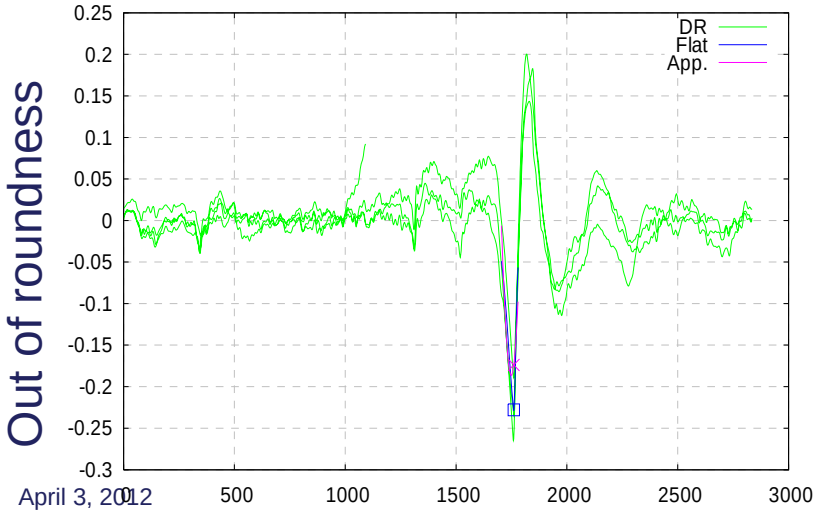
EP 1883 565: The signals are derived from the measuring elements, which displace the rails in the vertical direction and, then an information array is formed in the evaluation device from the signals, which corresponds at least to the periphery of the wheel. The periodic signal of the shapes of the wheel is evaluated with the aid of a Fourier development
http://tiny.cc/889qz

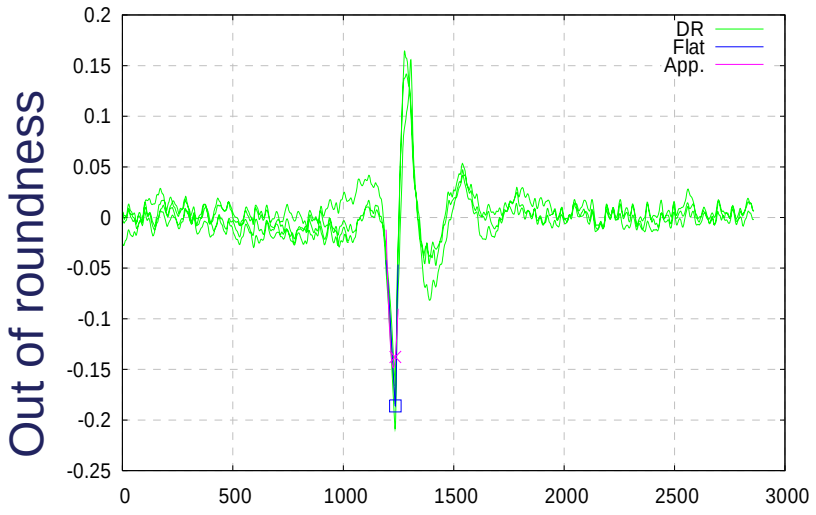
Argos® Dynamic wheel Q-force



Argos® Measurement of wheel defects



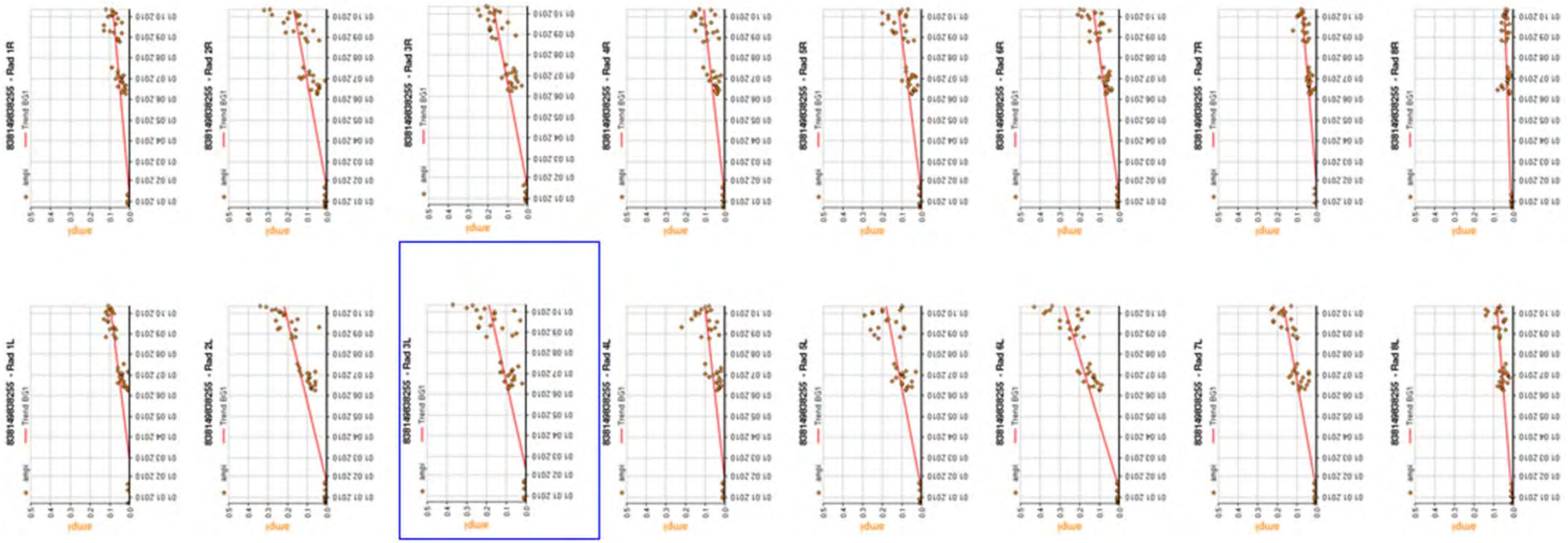




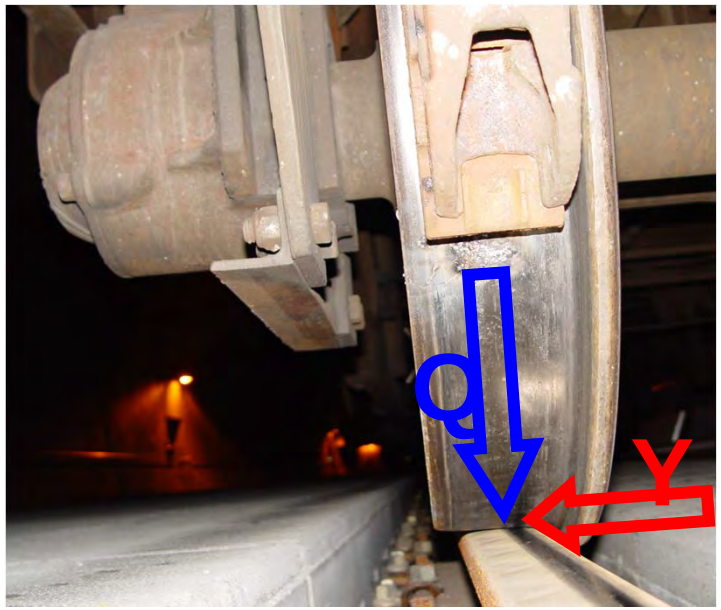
Example development of wheel defects

amplitude (out-of roundness)
wheel defects Bogie 1

amplitude (out-of roundness)
wheel defects Bogie 2



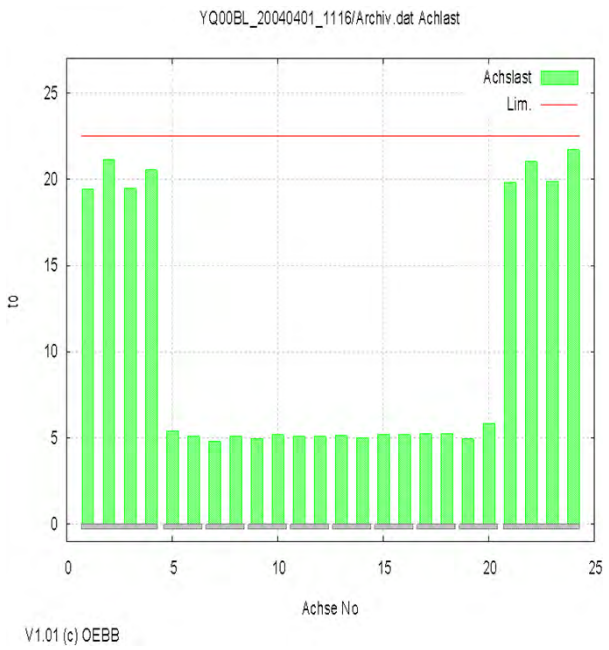
Argos® Level 3a - Y/Q derailment safety



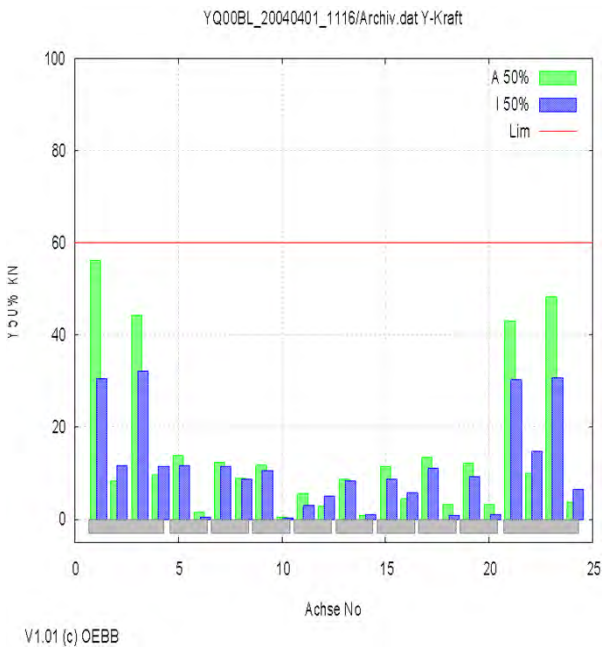
- Continuous vertical Q forces in curves
- Continuous lateral Y forces in curves
- Accuarcy better 2,5 % (Q/Y)
- Radius between 190m and 500m (installation on all track types possible, measuring lengh 12 meters)

Argos® Level 3a – Results

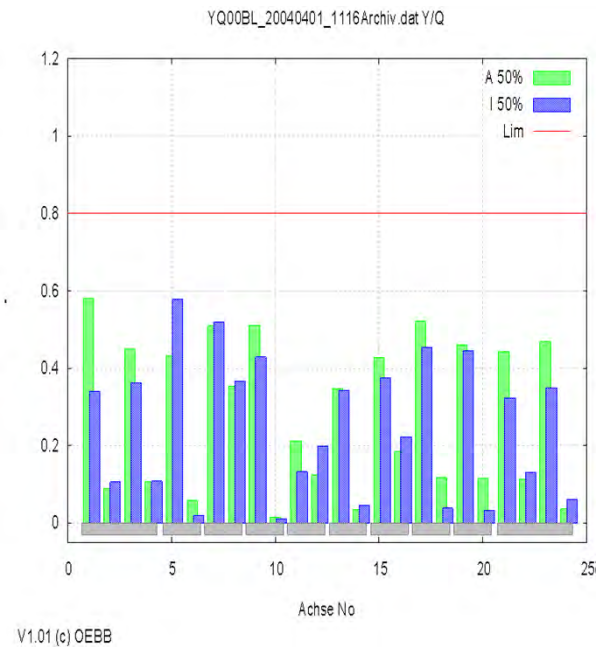
Achslasten (Q-Kräfte)



Y-Kräfte



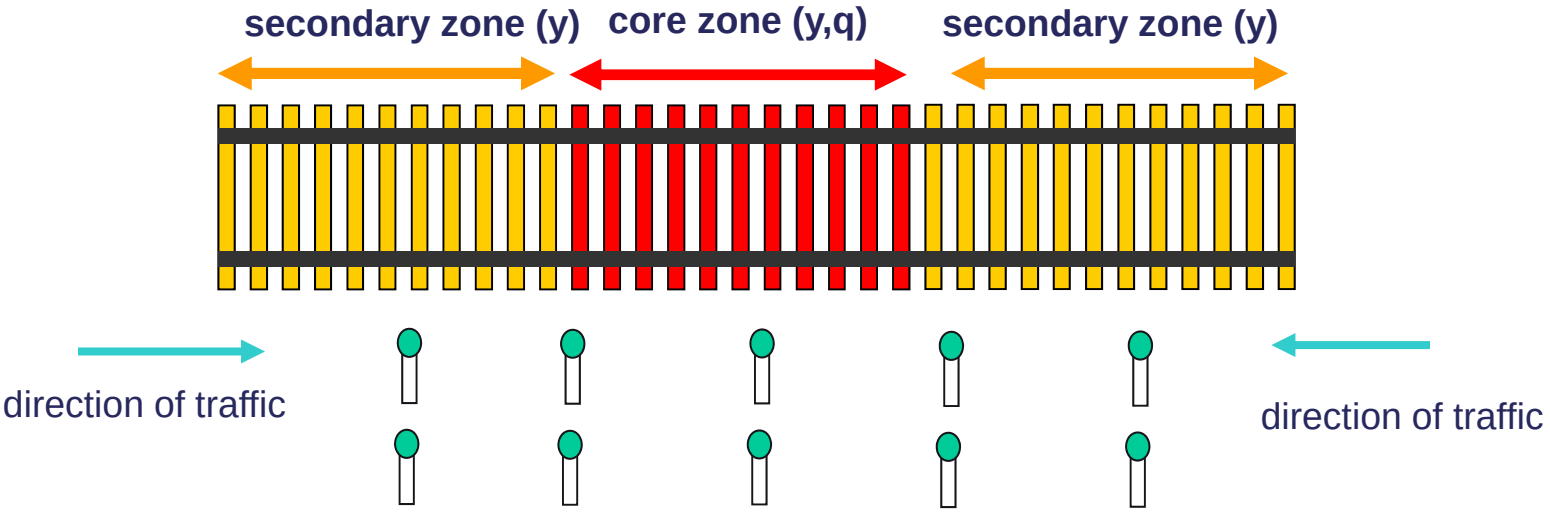
Y/Q



Argos® Level 3b – Instability and Noise

tan (gamma)=0.4 mean value

Length = min 25 m

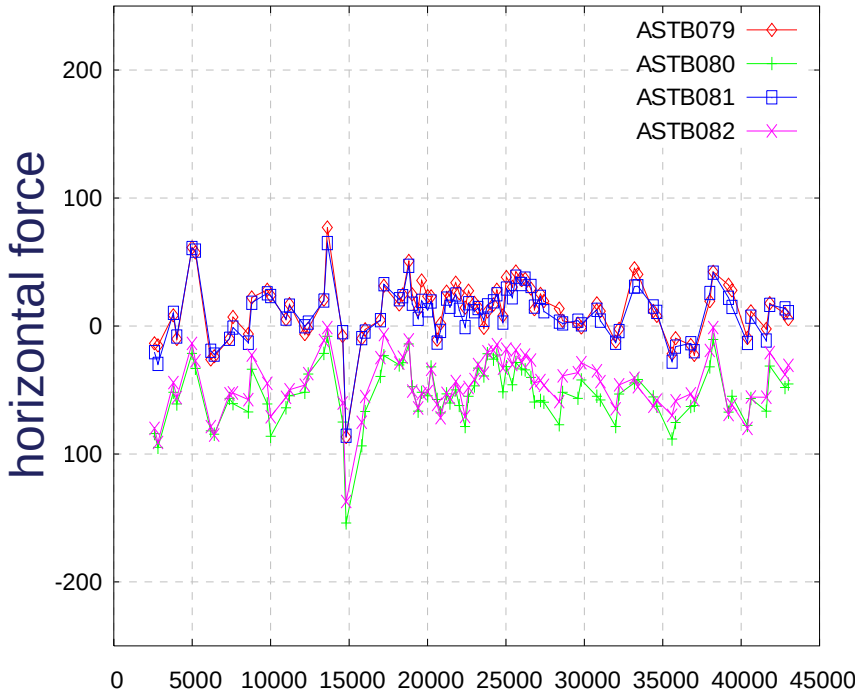


microfon and ground vibration measurement

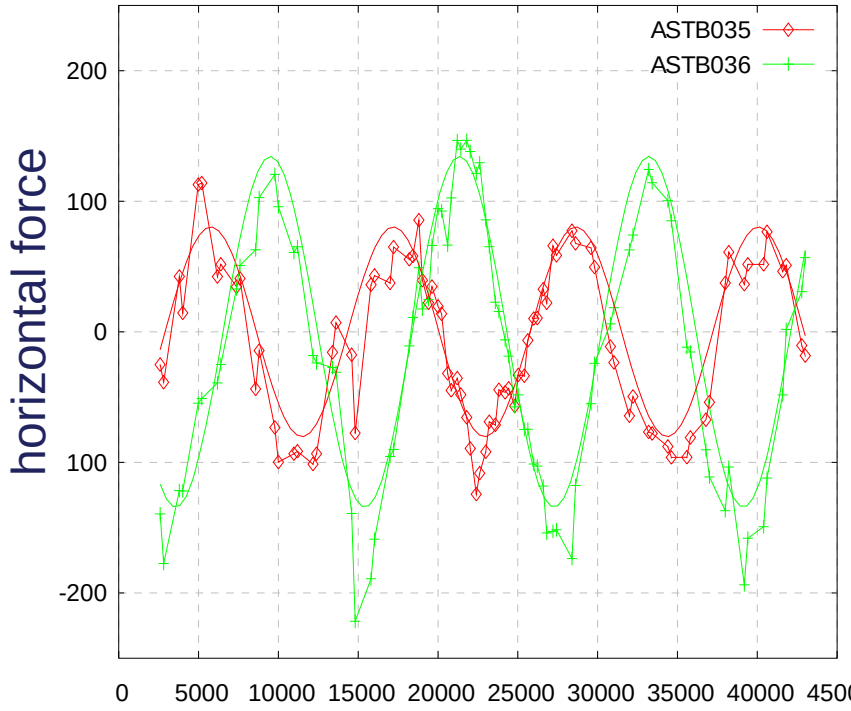
Argos® Level 3b – results hunting

stable / instable 2-axle vehicle

stochastic



resonance



Source: FFG-Bericht/BAMM

Argos® Automatic data handling

Limit exeeding reports,

red-reports, Alarms

Signaling

System

Permanent TCP/IP connection

Data transfer via FTP

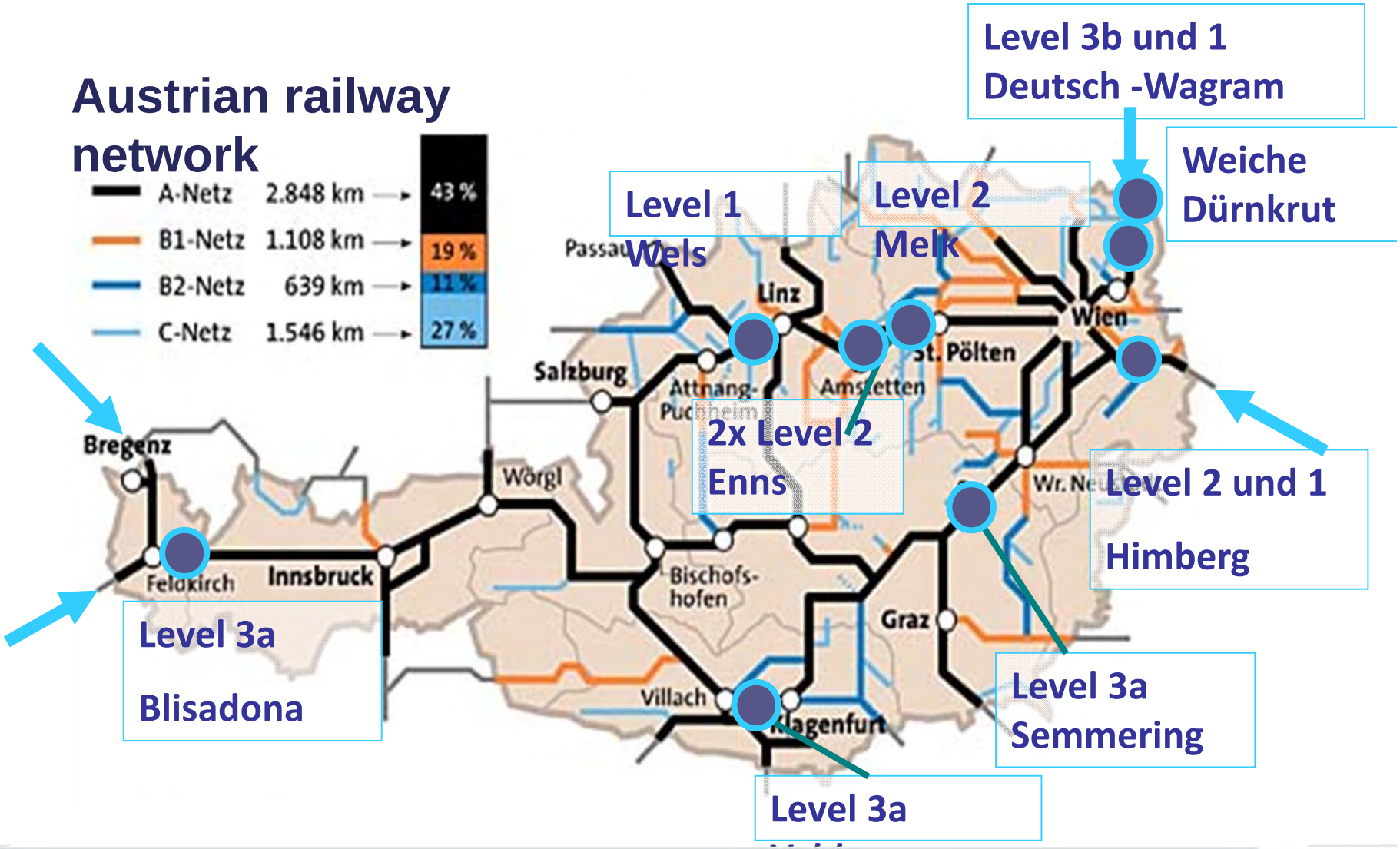
Data interfaces like xml, etc.

Result Handling:

User system: through web application

Expert system: through special applications (ARGOS-Client, ARGOS-Statistic), or data interfaces like xml, etc.

Argos® 10 systems installed in Austria



Argos® Cross Border Control System

Reduce stopping times in border stations

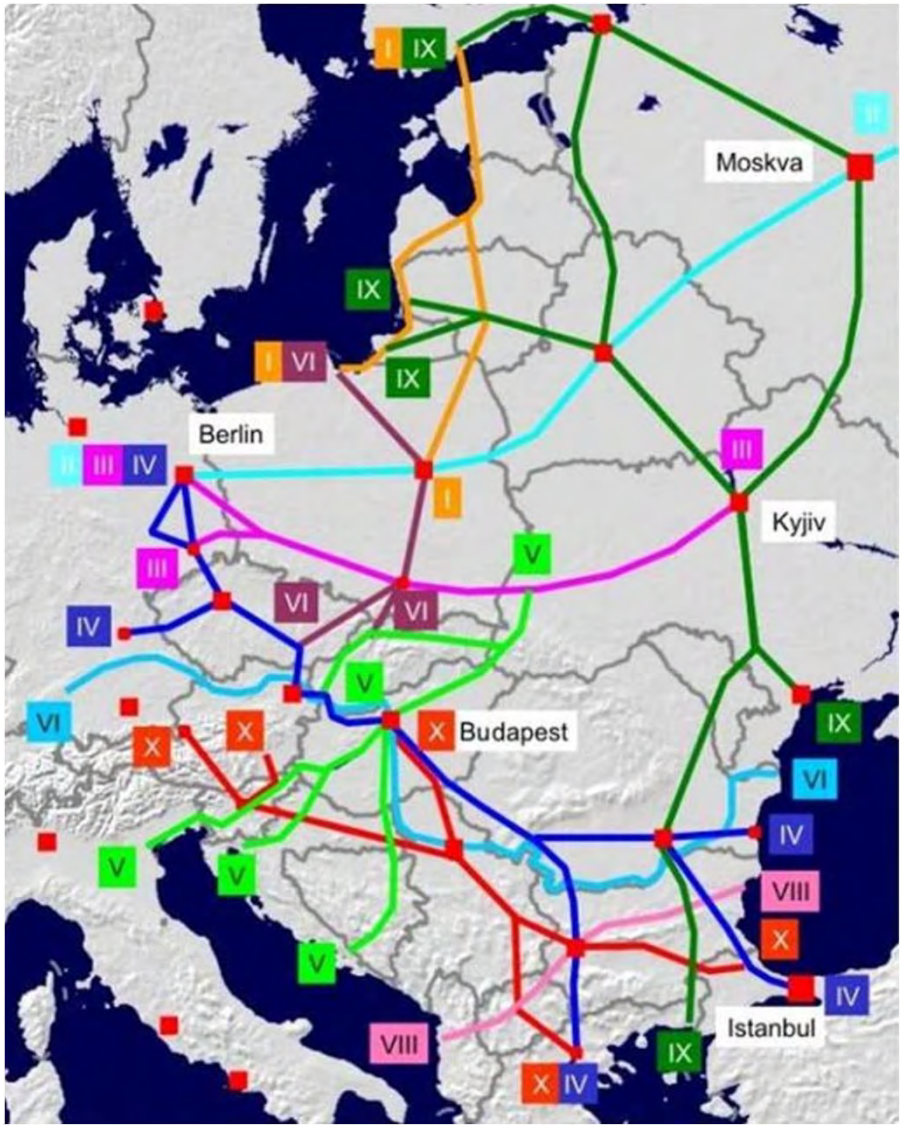
e.g.: Korridor X line railways partnership

„We connect nations by establishing an cross-border infrastructure for freight and passenger traffic which is in line with market requirements and budget-conscious.”

Argos® gives objective measuring results about

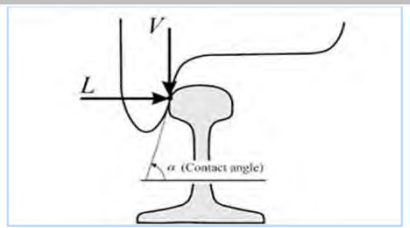
- running safety
- weights and overloads
- wheel defects

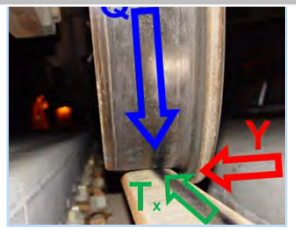
No further inspections of these properties at the border stations are necessary.

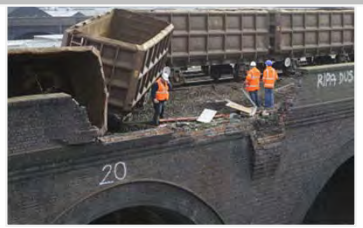


Why use wayside train monitoring systems?

Quickly and objectively know how about vehicles and tracks interaction reduce undesirable interaction situations







Enhanced Safety & Better Protection

and:

Correctly maintenanced and loaded vehicles reduce wear and Life cycle cost

Decreasing costs

Costs and efficiency

- To reduce maintenance costs = Seamless infrastructure integration is necessary

Example 10.000km line (mixed strait line + curves):

Invest to install 40 Argos Systems ca. 20 Mio€

Costs saving (study Ernst Basler & Partner)**:**

2-3 Mio€/year reduced maintenance costs

500 K€/year reduced costs after derailments

2-3 Mio€/year more income for correct freight pricing

Thanks

Walter Weilinger
Hottinger Baldwin Messtechnik Gmbh
Tel: +43 (0) 664 435 60 95
Walter.Weilinger@hbm.com

www.argos-systems.eu

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Wolfgang Zottl (ÖBB)
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