

# **Plasser Inertial Track Geometry Measuring System**

## **Installation on track maintenance machines**

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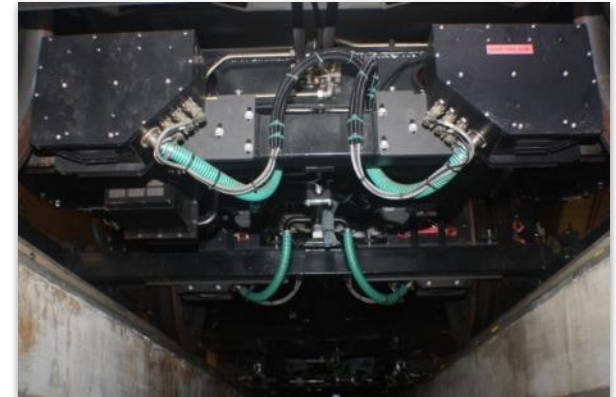
# Introduction

- Plasser & Theurer developed the Inertial track geometry system in the late 1990's
- Over 55 Inertial measuring systems installed worldwide
- The new trend is the installation of the system on track maintenance machines
- This open new possibilities and also new challenges

# Plasser Track Geometry Measuring System

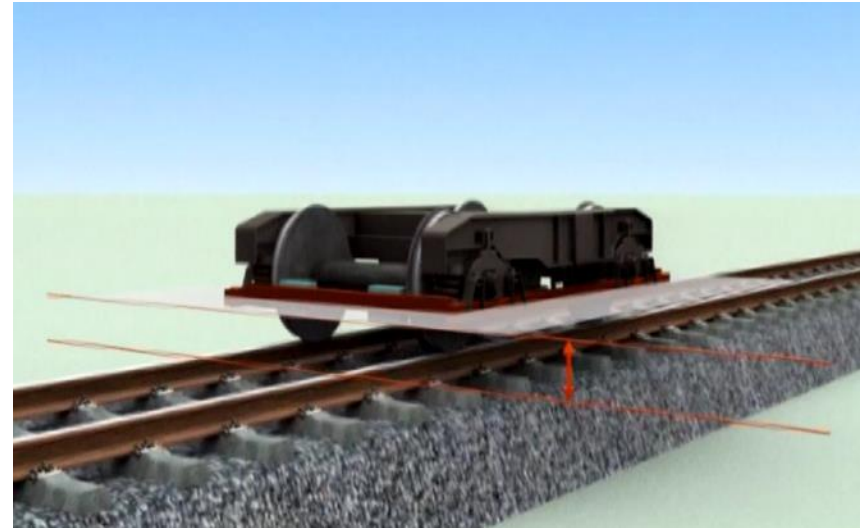
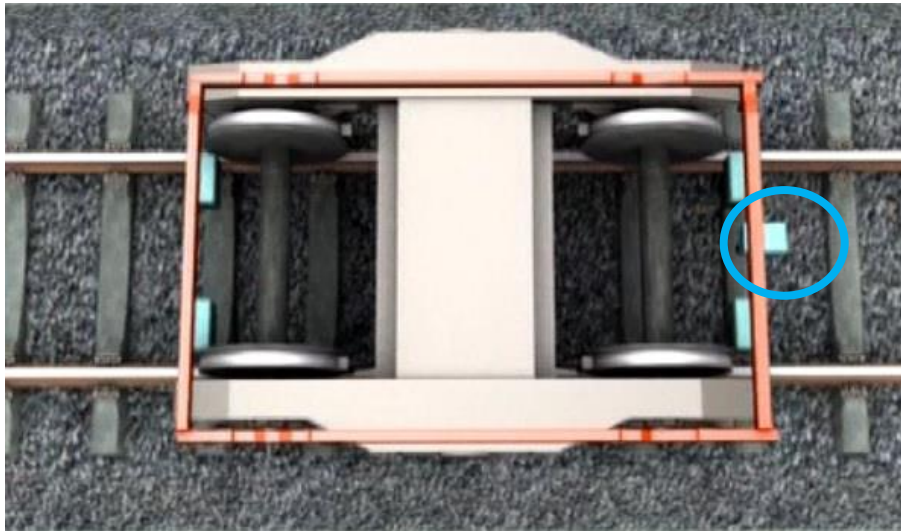
The system is composed of:

- Inertial measuring unit
- Navigational system
- Non contact gauge measuring system



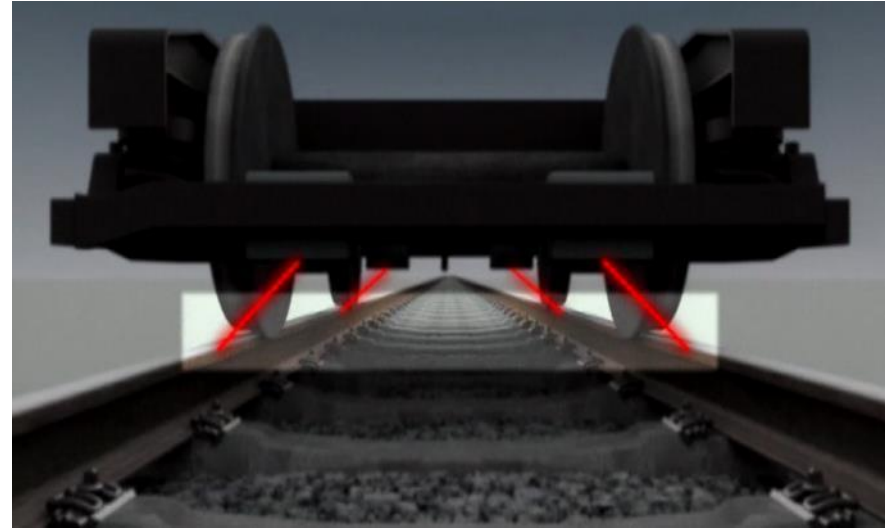
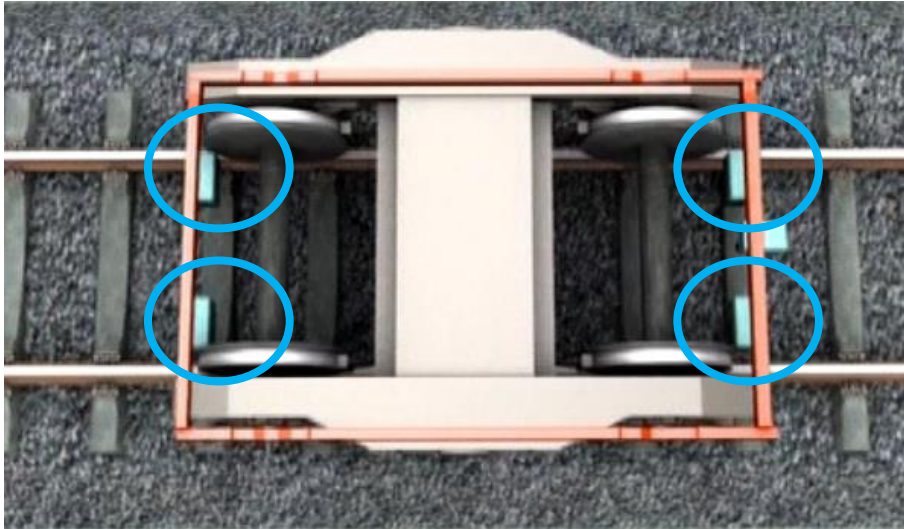
# Inertial Unit

The Inertial unit (IMU) is mounted on the measuring frame.  
The measuring frame is fixed on the axle bearings.

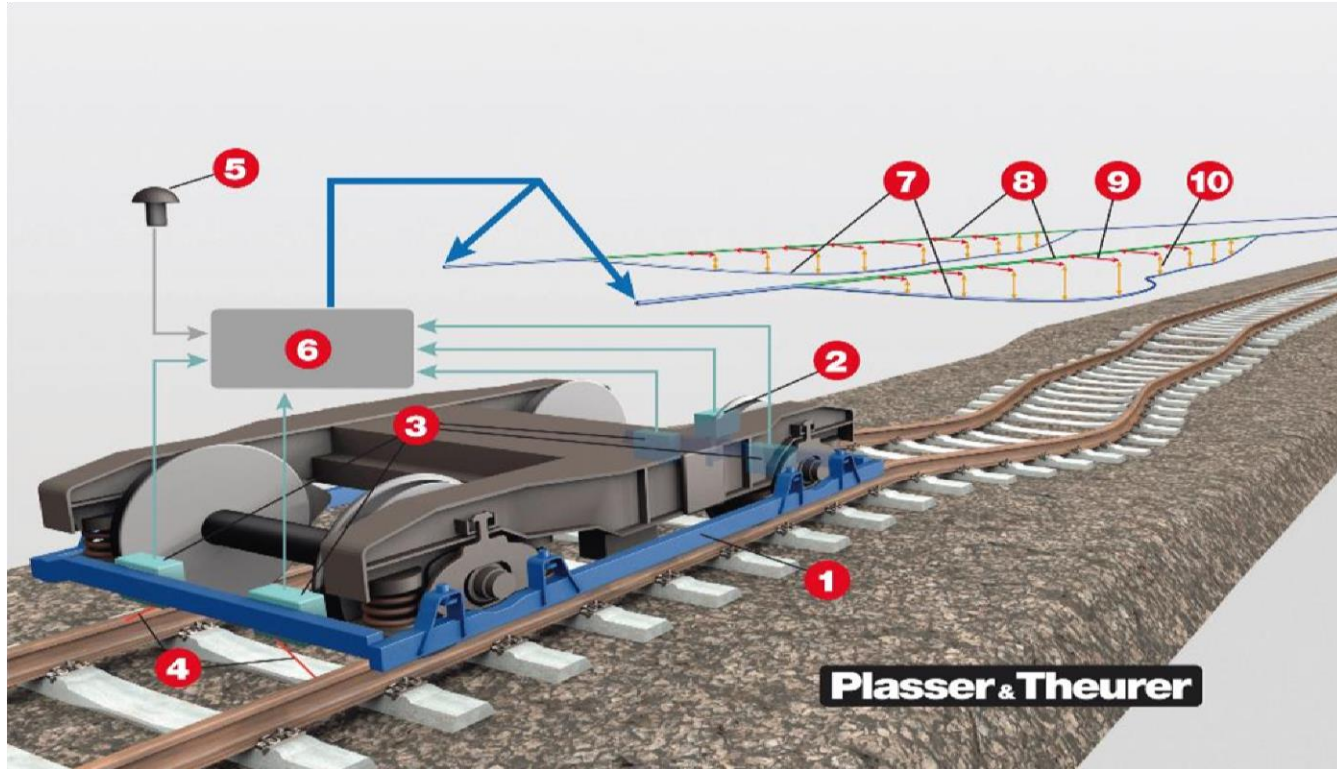


# Optical Gauge Measuring System

- Compensation of the horizontal movement of the bogie
- Gauge measuring



# Inertial Navigational Track Geometry



# Parameters

- Cross level
- Twist
- Gauge
- Longitudinal level (3 different wave and chord lengths)
- Alignment (3 different wave and chord lengths)
- Radius/Curvature
- Gradient

# Features

- No minimum speed required
- Measurement under load
- Excellent reproducibility
- No vertical compensation required
- Integrates GNSS
- GNSS even available in areas with no GNSS reception
- Compliant with the European Standard EN13848



# Installation on Tamping machine



# Use of the system on tamping machines

- Use of the tamping machine as a measuring car
- Measurement for acceptance of the work performed
- Speed up spot intervention for single exception
- Pre-Measurement to define the design track geometry
- Absolut track geometry measurement (development in progress)

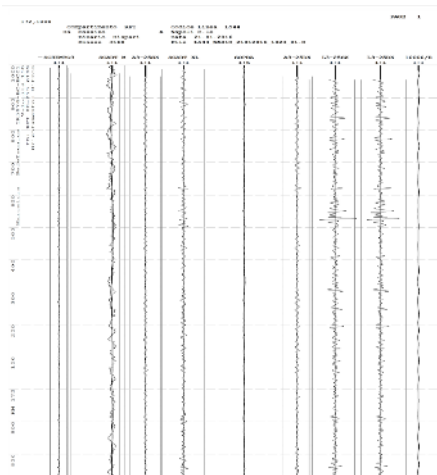
# Tamping machine as measuring car

- The tamping machine is traveling to and from the construction area. The measured data are therefore “for free”
- Onboard Analyses
  - Output of single Exception and evaluation in real time
  - Calculation of quality indexes (e.g. TQI)
  - Identification of defective areas
- Integrated database for track speed, class of the section, events, etc.



# Measurement for work acceptance

- No measuring speed limit
- Verification of long wavelength defects (D2/D3)
- Documentation output according to local standards



INVIOLATA PROTEZIONE  
Dati personali

Allegato: NA

## COMUNICAZIONE DI DIFETTI RILEVANTI

Si indica che nella serie di verifiche d'attesa della vettura di riferimento:

Numero: 88.02.009  
Data: 19/07/2008  
Vettura: Biquat  
per l'indirizzo: ANM  
sono stati rilevati i seguenti difetti rilevanti:

| Traffia        | Prognostica   | Parametro        | Valore Max | Min/Max | Procedimento di<br>intervento |
|----------------|---------------|------------------|------------|---------|-------------------------------|
| LOC048-KC-0020 | 0,272 - 0,432 | Usc. L&R 0-25    | -34,1      | 0,432   | Null 80 km/h                  |
| LOC048-KC-0020 | 0,261 - 0,432 | Scambio          | 30,5       | 0,432   | Null 80 km/h                  |
| LOC048-KC-0020 | 0,542 - 0,551 | In. D1 0-25      | 18         | 0,551   | Null 80 km/h                  |
| LOC048-KC-0020 | 0,261 - 0,392 | Scambio          | 24,7       | 0,392   | Null 80 km/h                  |
| LOC048-KC-0020 | 0,251 - 0,358 | In. D1 0-25      | -23,3      | 0,358   | Null 80 km/h                  |
| LOC048-KC-0020 | 0,250 - 0,387 | Scambio Sm       | 8,7        | 0,387   | Intervento                    |
| LOC048-KC-0020 | 0,261 - 0,385 | Scambio Scambio  | 18,5       | 0,385   | Intervento                    |
| TRC020-KC-0024 | 0,621 - 0,638 | Usc. L&R 0-25    | -27,8      | 0,638   | Null 80 km/h                  |
| TRC020-KC-0021 | 0,641 - 0,668 | Scam. ANM (km/h) | 1029,8     | 0,668   | Null 80 km/h                  |
| TRC020-KC-0021 | 0,641 - 0,671 | Usc. D1 0-25     | -23,7      | 0,671   | Null 80 km/h                  |
| TRC020-KC-0021 | 0,554 - 0,567 | In. D1 0-25      | -23,9      | 0,567   | Null 80 km/h                  |
| TRC020-KC-0021 | 0,497 - 0,499 | Scam. ANM (km/h) | 1029,6     | 0,499   | Null 80 km/h                  |
| LOC020-KC-0021 | 0,251 - 0,354 | In. D1 0-25      | -23,2      | 0,354   | Null 80 km/h                  |
| LOC020-KC-0021 | 0,251 - 0,358 | Usc. L&R 0-25    | -23,5      | 0,358   | Null 80 km/h                  |
| TRC020-KC-0021 | 0,626 - 0,658 | In. D1 0-25      | 16,8       | 0,658   | Null 80 km/h                  |
| TRC020-KC-0021 | 0,626 - 0,657 | Scam. ANM (km/h) | 1029,8     | 0,657   | Null 80 km/h                  |

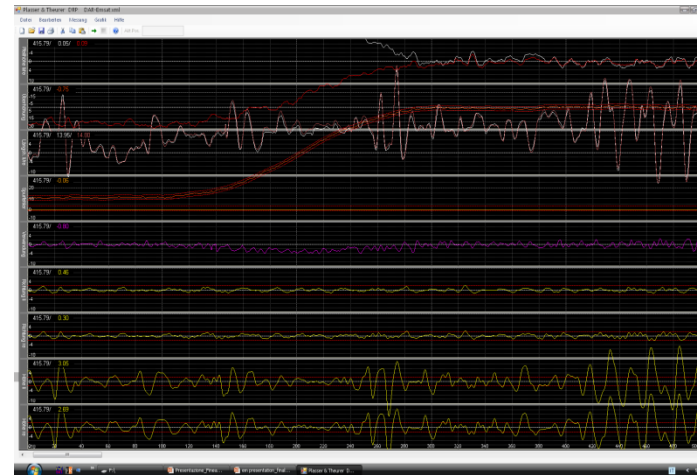
Data:

Completata:

Valore calcolato: 24.0.0.0.0

Col:

Nota: da inviare alla Fer a cura dell'Ufficio CD al Materiale presso l'Ufficio di competenza.



# Spot intervention (Single Exception)

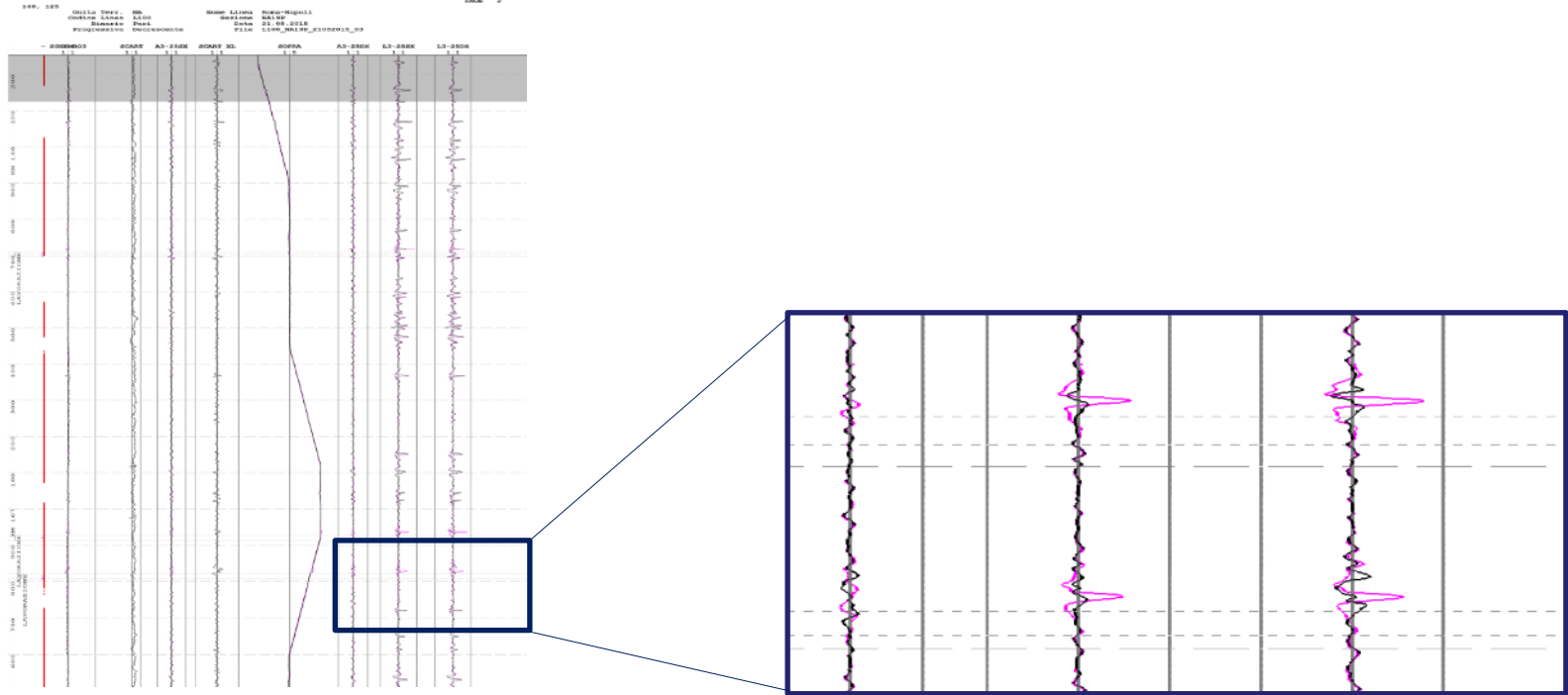
- Additional device for fast detection of the defect, using inertial navigational data
- Measurement before and after



| Line | Code   | Track | Dispari | Max Exception Location | Measure Parameter Name | Max Amplitude |
|------|--------|-------|---------|------------------------|------------------------|---------------|
| km   | meters |       |         |                        |                        |               |
| 199  | 322.25 |       |         |                        | Liv. L. SX 3-25        | -9.73         |
| 199  | 322.00 |       |         |                        | Liv. L. DX 3-25        | -8.91         |
| 197  | 33.00  |       |         |                        | Liv. L. SX 3-25        | 8.71          |

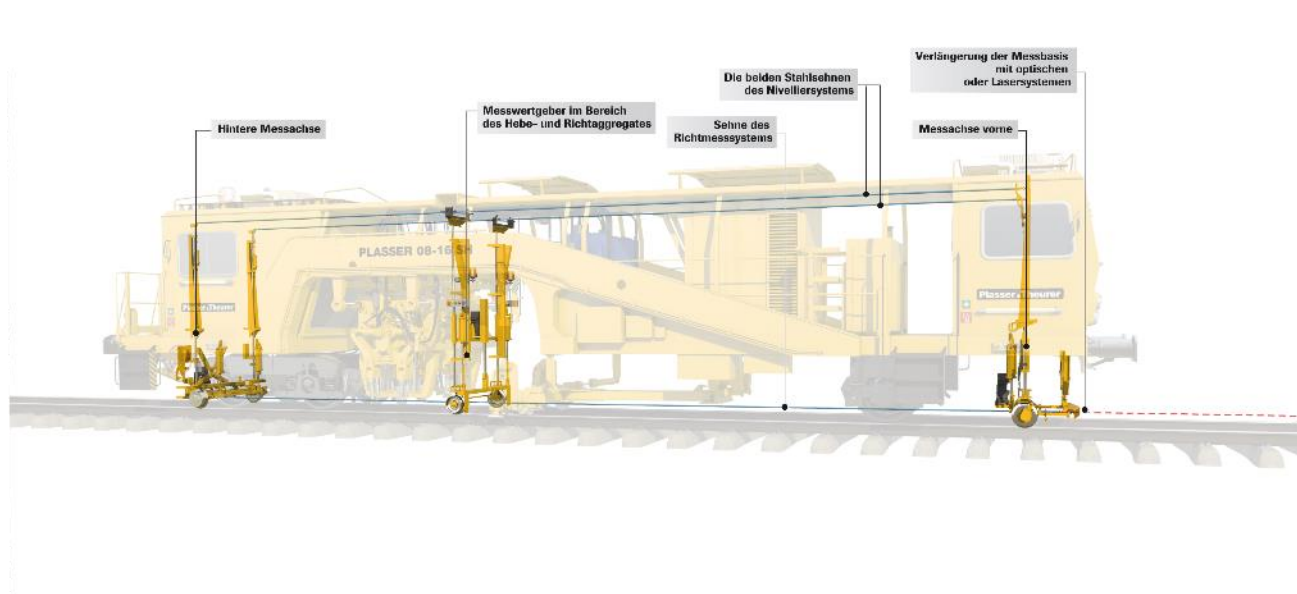
**Distance To Exception:**  
 Start (km)    Max (km)    End (km)    Exception Length (m)  
 176.0    176.0    176.0    1.00

# Spot intervention, Documentation before / after



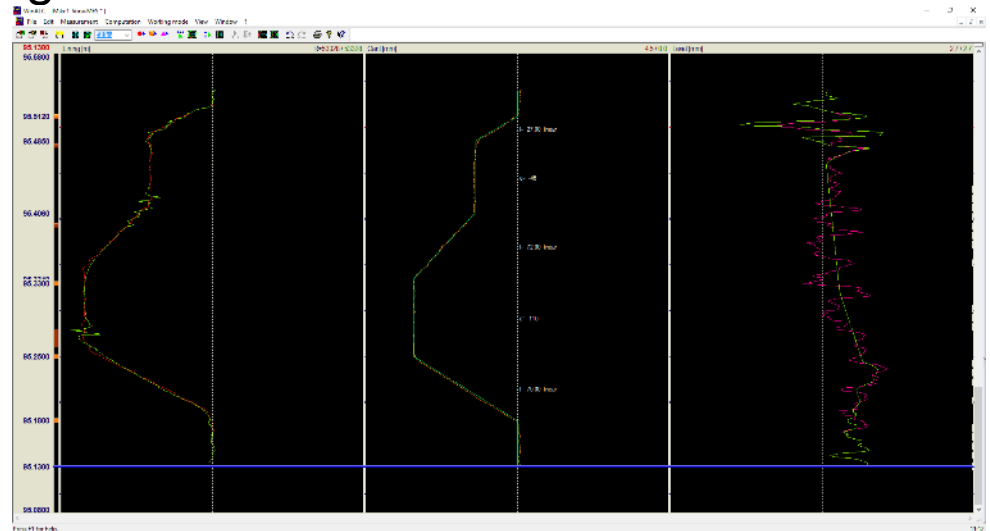
# Working principle tamping machines

Three measuring axles create the reference of the lifting and lining system  
ALC – Automatic guiding computer



# Design of track geometry

- Pre-Measurement with the Inertial Measuring system
- Definition of the design superelevation and curvature
- Calculation of lifting and shifting values
- Transfer to the ALC





# Absolute track geometry measurement

- Measurement of the Fixpoints using an optical system
- Space curve measurement between Fixpoints using the Inertial track geometry system
- Combination of both data
- Calculation of shifting and lifting values

**S**ystem under development

# Conclusion

The Inertial track measuring system installed on tamping machines improves the speed and quality of the work.

Trend: More measuring technology on maintenance machines.