System for Automatic Crane Measurement

TS9D Machine Guidance and Integrated Measurement Systems

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System for Automatic Crane Measurement

- ***system description***
- ***prototype development***
- ***system calibration***
- ***test measurements***
- ***conclusion***

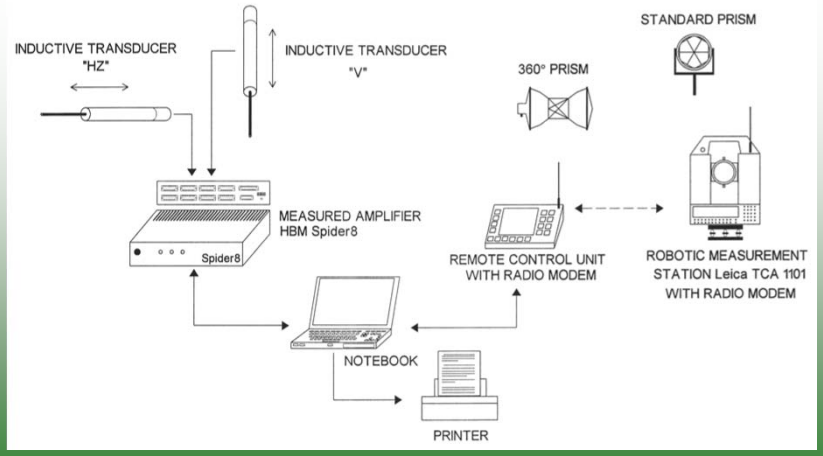
FIG XXIV Congress, TS 9D *Sydney, 11-16 April 2010*

System Description

Measurement system structure

- robotic measurement station Leica TCA 1101,
- standard prisms,
- 360° prism,
- portable operative personal computer,
- measured amplifier HBM Spider8,
- inductive transducers HBM WA100,
- DC/AC power inverter (DC 12V to AC 230V, 50 Hz), battery DC 12V
- power, terminal and connecting cables.

Measurement system structure



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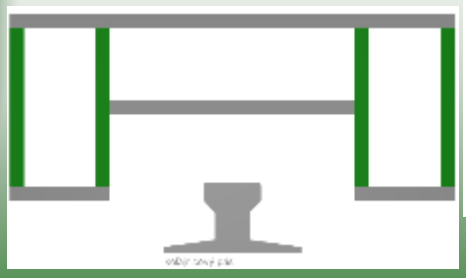
Measurement system structure

- ***dural U shape bearing structure***



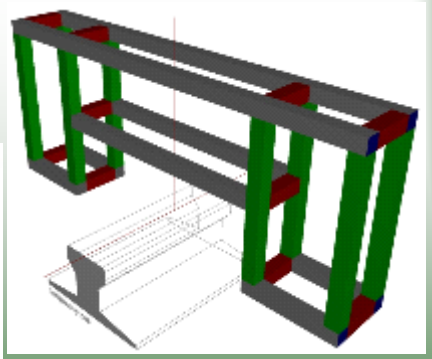
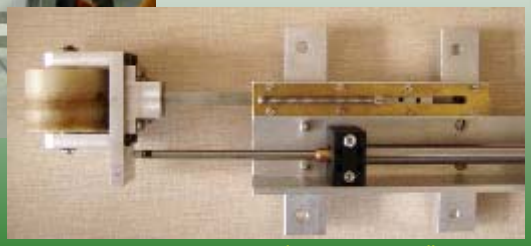


FIG XXIV Congress, TS 9D *Sydney, 11-16 April 2010*

Measurement system structure



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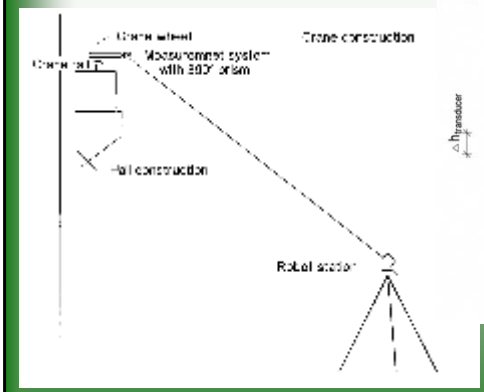
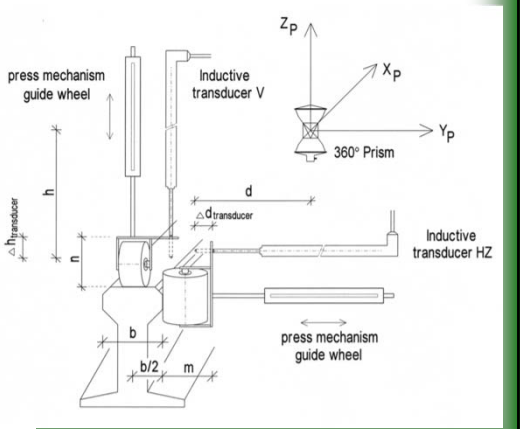
Measurement system structure





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Measurement system structure

$$\begin{pmatrix} x \\ y \\ H \end{pmatrix} = \begin{pmatrix} x_P \\ y_P \\ H_P \end{pmatrix} + s \begin{pmatrix} \cos(\beta)\cos(\alpha) \\ \cos(\beta)\sin(\alpha) \\ \sin(\beta) \end{pmatrix} + \cos(\beta_{NK}) \begin{pmatrix} \left(d \quad \Delta d \mid m \mid \frac{b}{2}\right)\cos(\alpha_{NK}) \\ \left(d - \Delta d + m + \frac{b}{2}\right)\sin(\alpha_{NK}) \\ h - \Delta h + n \end{pmatrix}$$

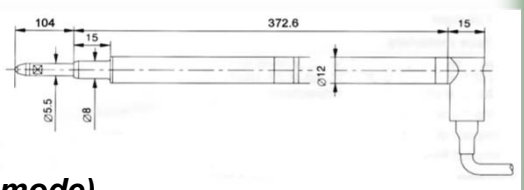
Prototype development

Prototype development

- dural structure with shifting mechanism
- guide wheel with pressure mechanism
- vertical and horizontal inductive transdrucers

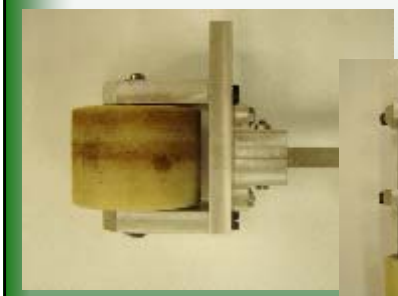
Prototype development

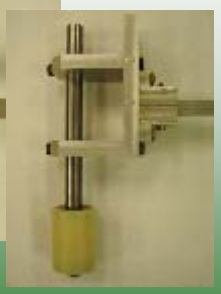
- ***measuring range 0 – 100 mm***
- ***accuracy 0,01 mm***
- ***linearity < 0,2 %***
- ***measurement rate 0 – 9600 Hz (static and dynamic mode)***



Prototype development

- **modification of the guide wheels**
- **magnification of the wheel pressure**





Prototype development

- ***4 analog and 8 digital inputs***
- ***output for PC – LPT or RS232***
- ***software Conmes Spider***

Prototype development

- time synchronization of data acquisition
- real-time data processing
- track position determination by RTS

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System calibration

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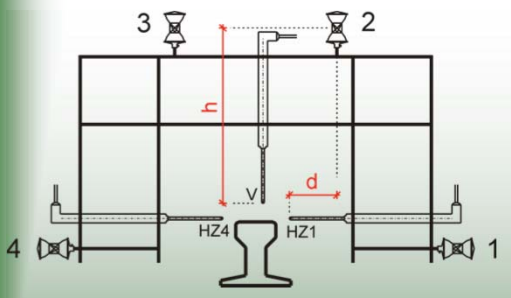
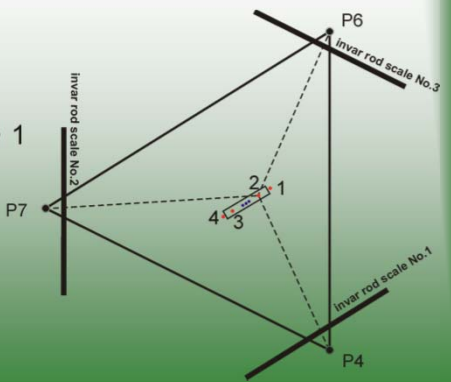
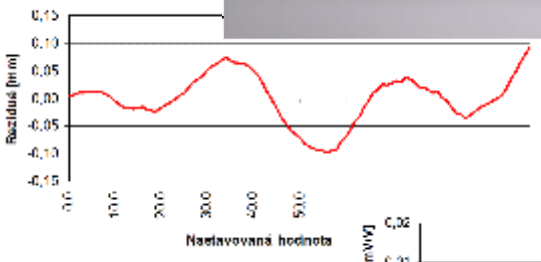
System calibration

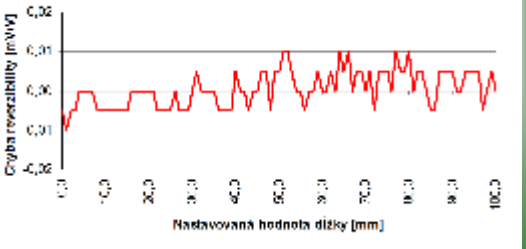




System calibration



Linearity error < 0,1 %



Test measurements

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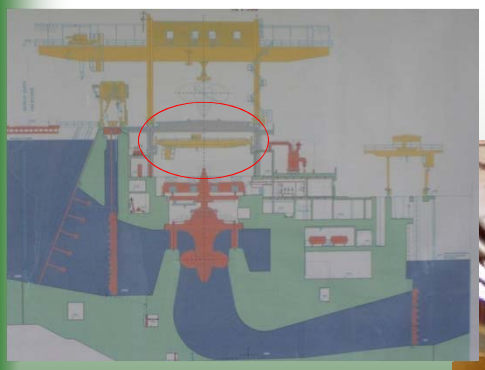
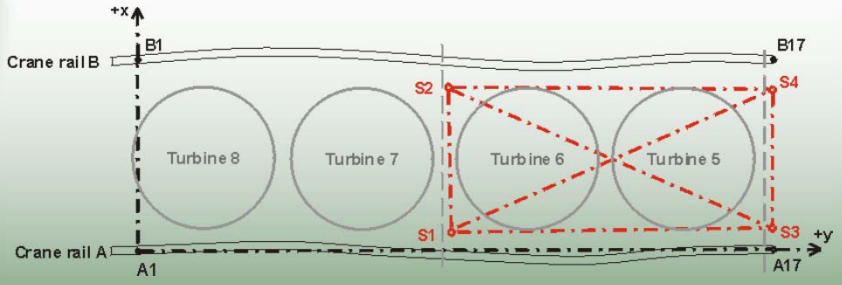


- **HPP Gabcikovo 8 x 80 MW**

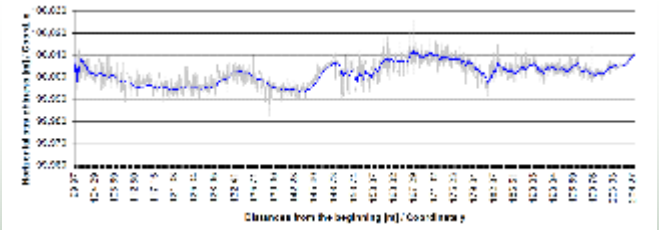
Test measurements

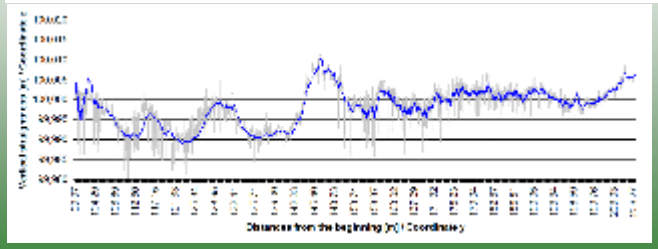


Test measurements

- ***crane geommetry 241,0 m x 17,7 m***
- ***32 tons***
- ***106,4 m measured length***

Test measurements





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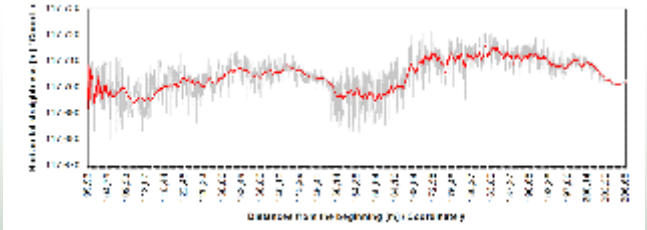

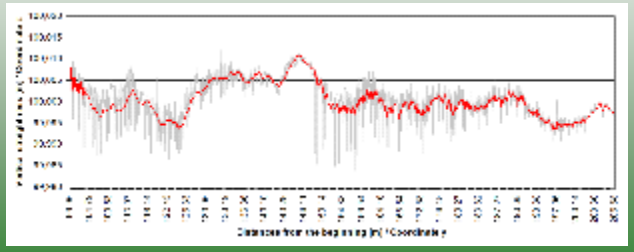

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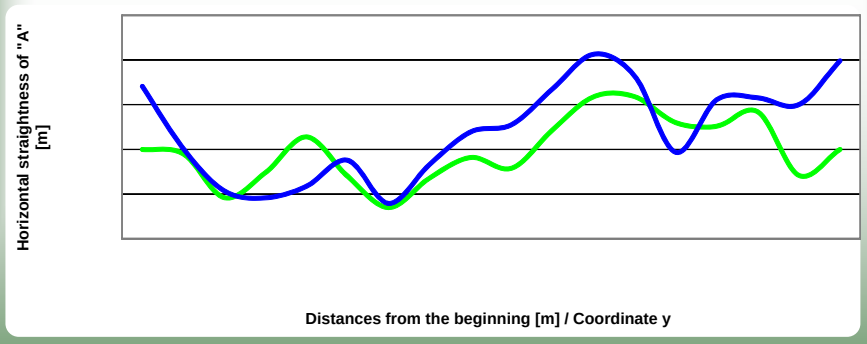

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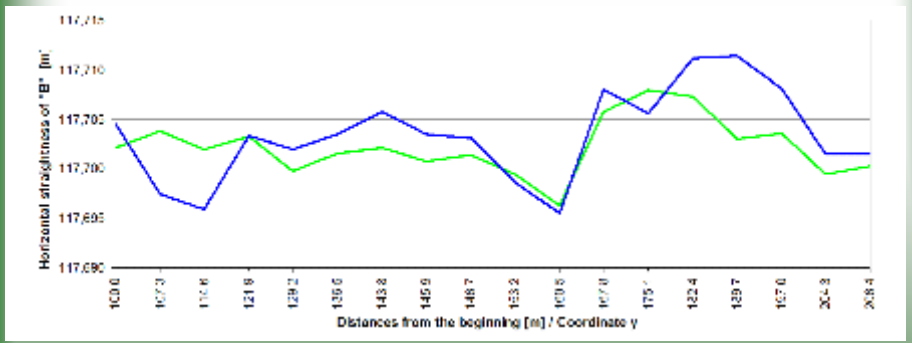

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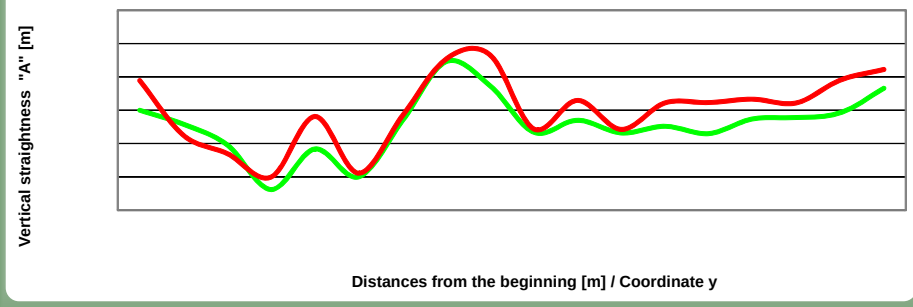

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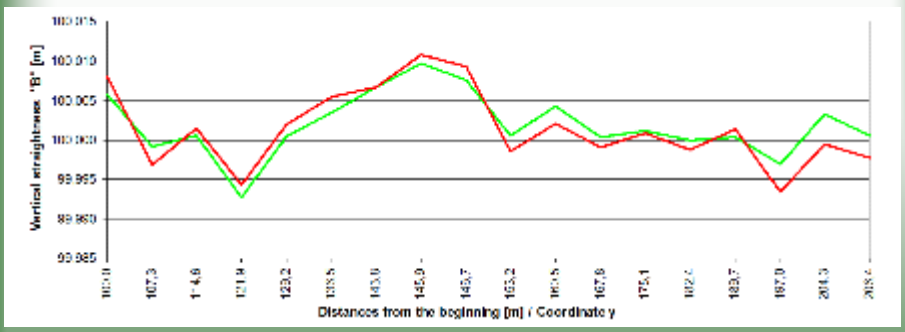
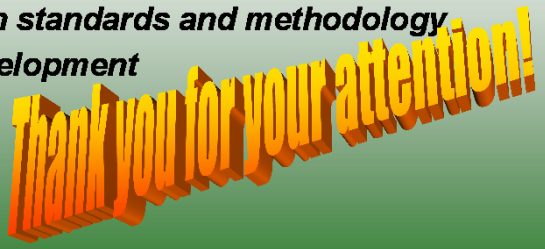


Conclusion

- *velocity of crane movement up to 5 m/s*
- *density of measured points 38 mm*
- *absolute accuracy achieved 2-3 mm*
- *internal accuracy achieved up to 0.1 mm*
- *maximal safety of measuring personal*
- *changes in standards and methodology*
- *future development*



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