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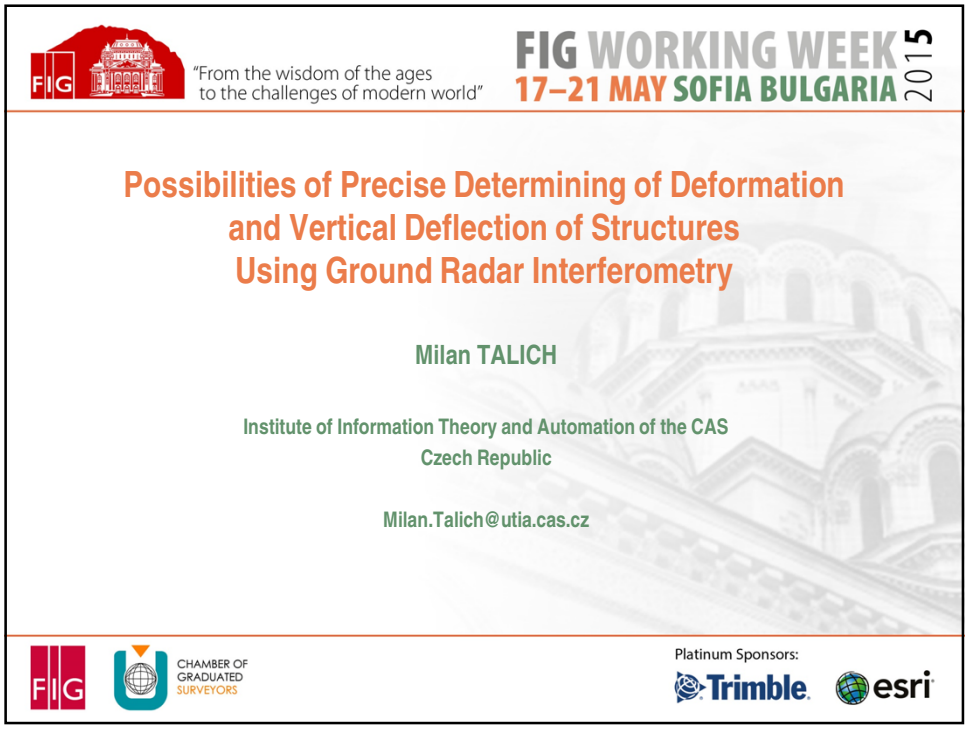
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Possibilities of Precise Determining of Deformation
and Vertical Deflection of Structures
Using Ground Radar Interferometry
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Moto:

- New geodetic technologies like radar interferometry and ground base radar interferometry with synthetic aperture (GB InSAR) can be used with success for deformation monitoring.
- This new technologies are mainly use for determining the deformations of:
  - deflections of bridges,
  - horizontal movements of wind power towers, chimneys, water towers, high buildings, …
  - landslides in dangerous areas,
  - horizontal movements of dams,
  - etc.

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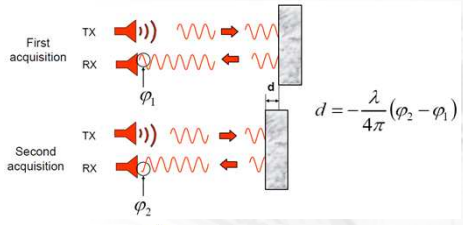
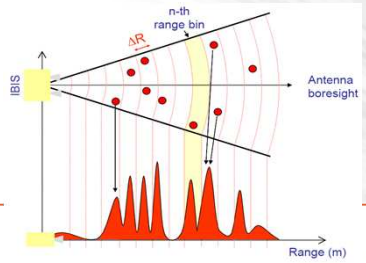
Principles of radar interferometry

Radar interferometry



Stepped frequency wave



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Instrument characteristics - IBIS-FS

- producer: Ingegneria Dei Sistemi S.p.A., Italy
- terrestrial coherent radar interferometer
- microwave spectrum with mean frequency of 17 GHz
- sampling frequency from 10 to 200 Hz
- maximum effective range is 1 km
- standard deviation according to manufacturer is 0.01 mm
- resolution is 0.75 m in range direction

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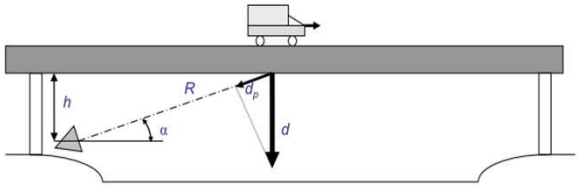
Line of sight movement and real movement

- The displacement is measured in the direction of the line of sight of the system
- To calculate the real displacement is needed to know the acquisition geometry



$d=d_p \cdot R/h$ The distance R is measured by IBIS

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Radar interferometry (IBIS-S) advantages

IBIS-S introduces a totally new method for the dynamic and static monitoring of movements, with significant advantages over traditional including:

- **Remote sensing**, without the need to access the structure;
- **Fast and easy to install**; complete monitoring of the entire structure performed quickly (e.g.: an entire bridge can be dynamically monitored in less than one hour)
- Provides a practically continuous **mapping of the dynamic displacements** of the entire structure
- Directly measures the structural displacements **in real time**, with an **accuracy of between 1/100 and 1/10 of a mm**
- Can follow and accurately measure both slow movements and fast movements in the **frequencies range [0-50 Hz]**

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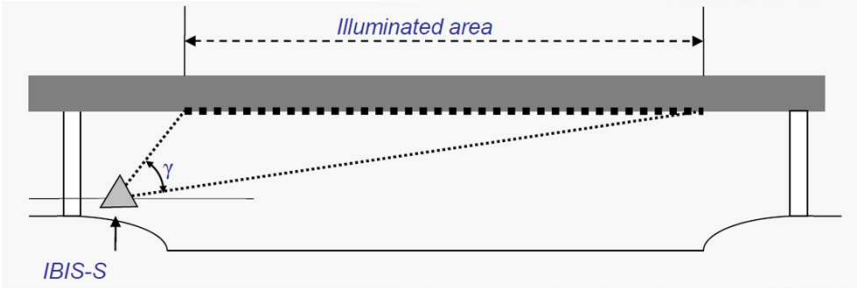
A method of monitoring bridges



Current monitoring of the entire bridge or a selected part

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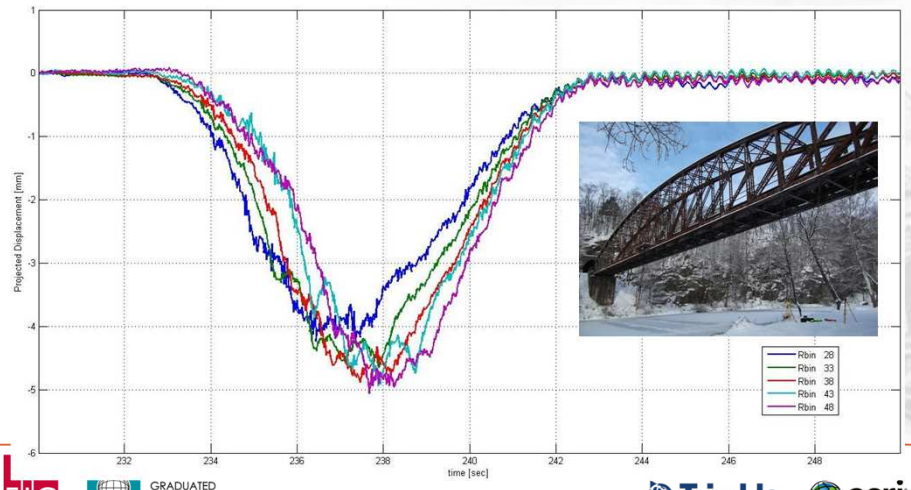
Example of the bridge in Rataje nad Sázavou



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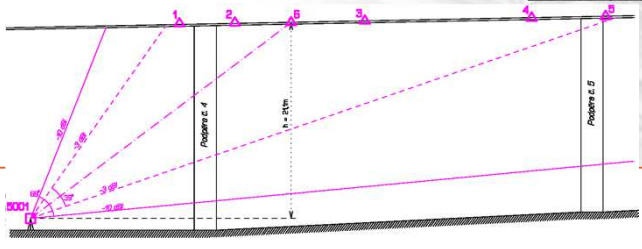
Example of the road bridge near Pelhřimov



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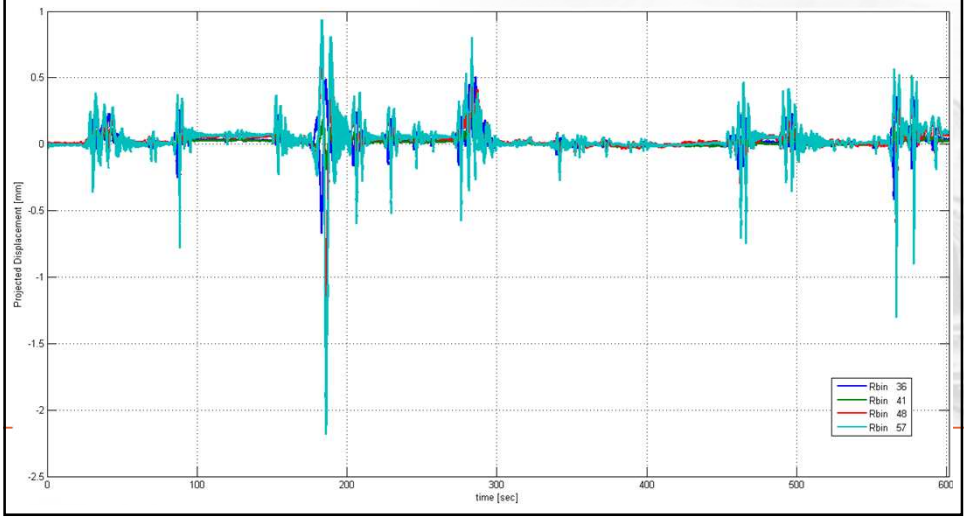
Deflections of bridge during 10 min measurements



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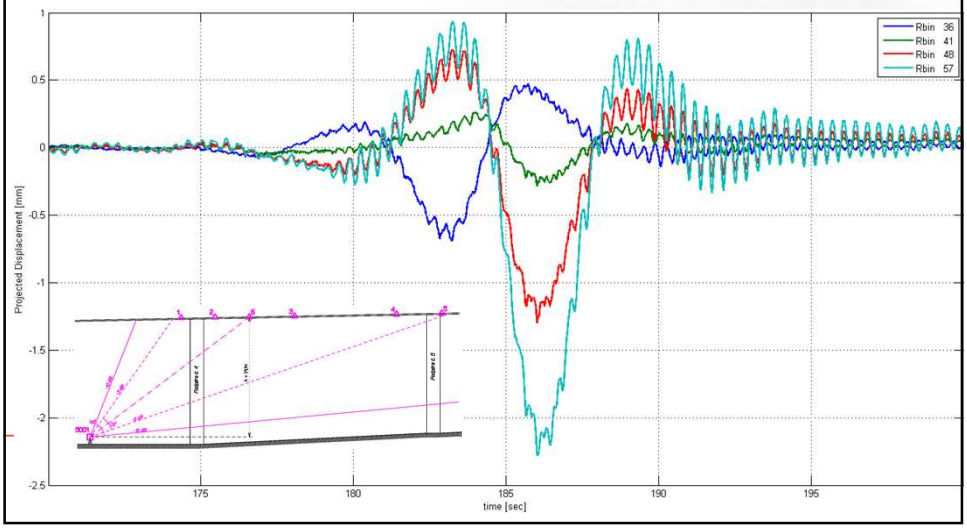
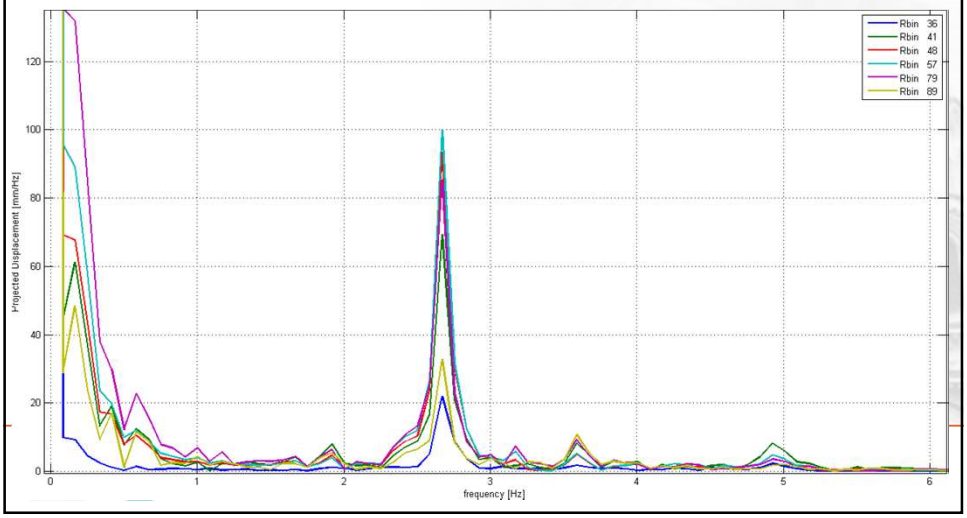
Detail 30 sec



Frequency Analysis



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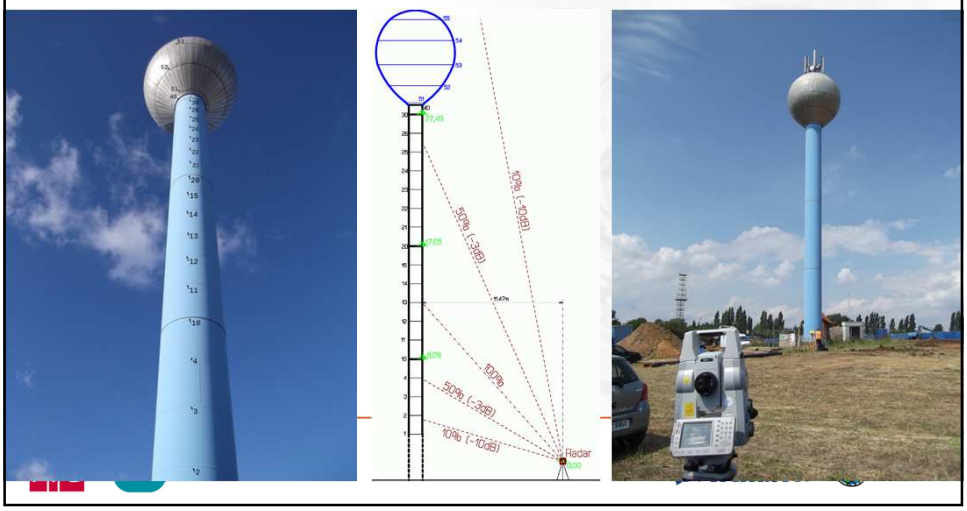
Horizontal movements of water towers



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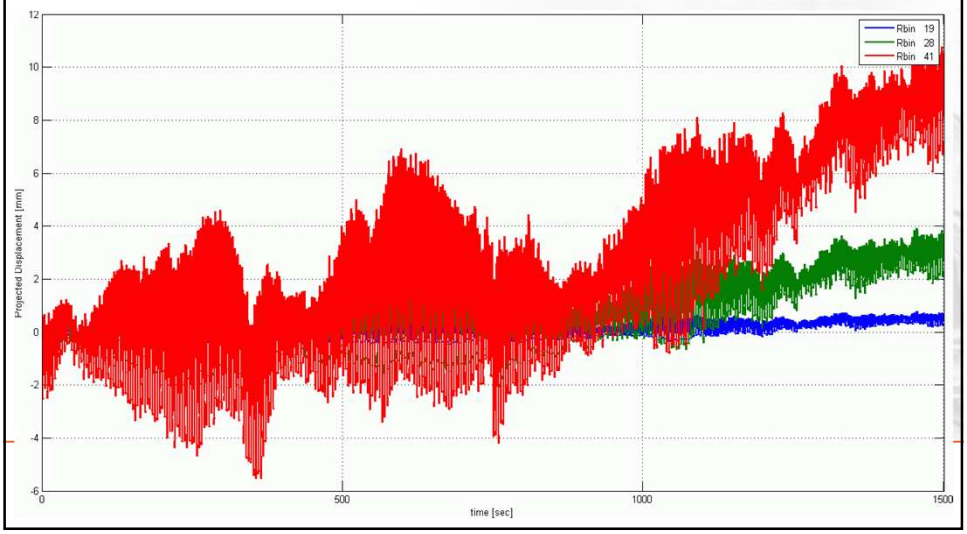
Horizontal movements of water towers during 25 min



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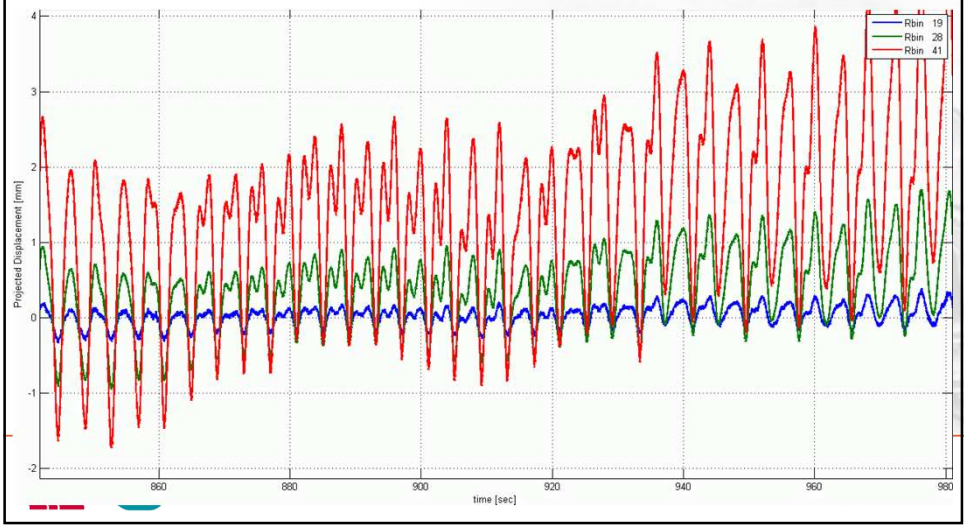
Detail during 140 sec



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Horizontal movements of wind-power plant pylons

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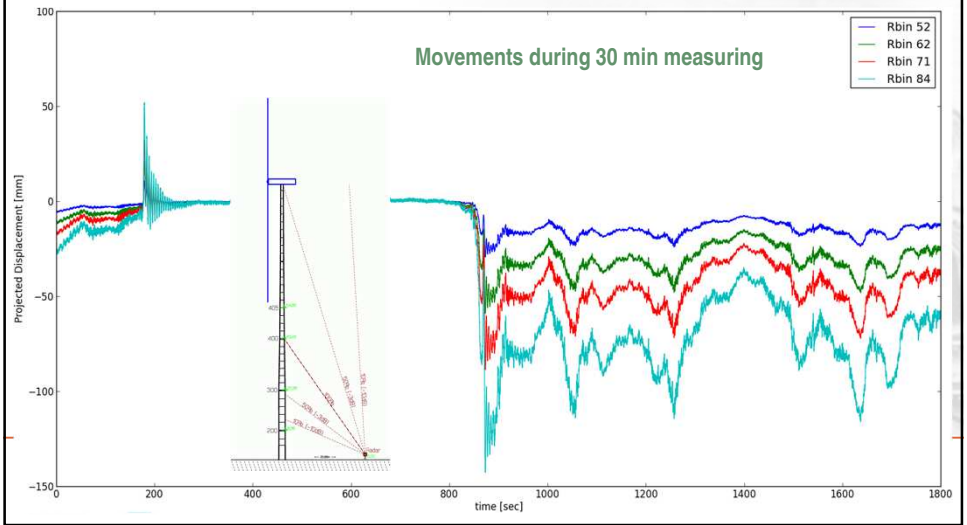

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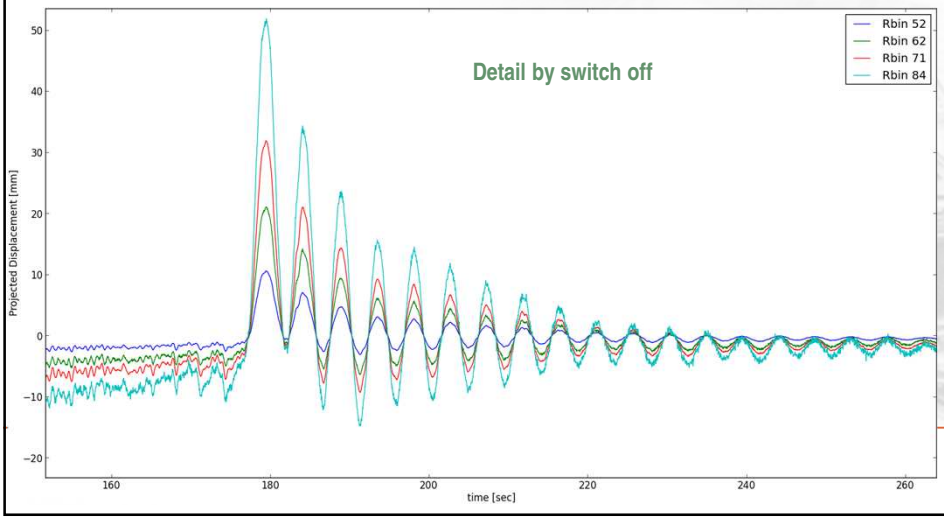

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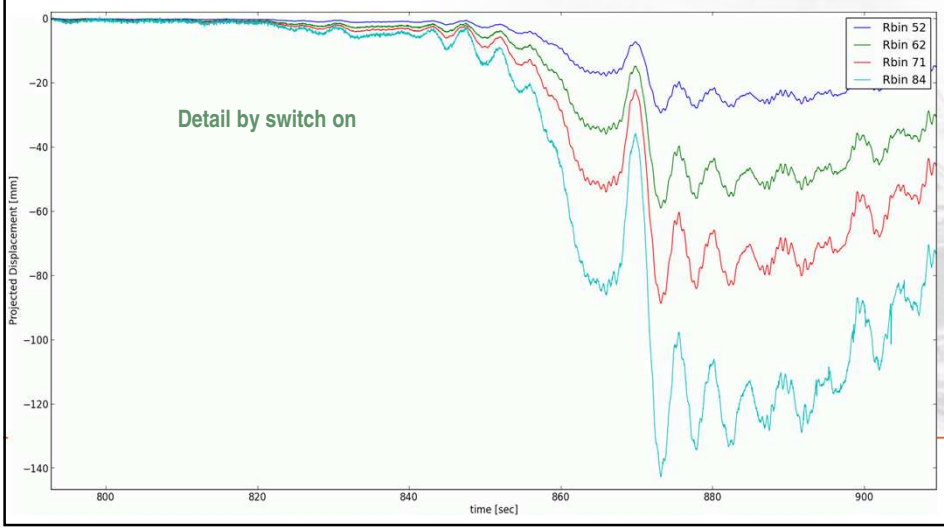

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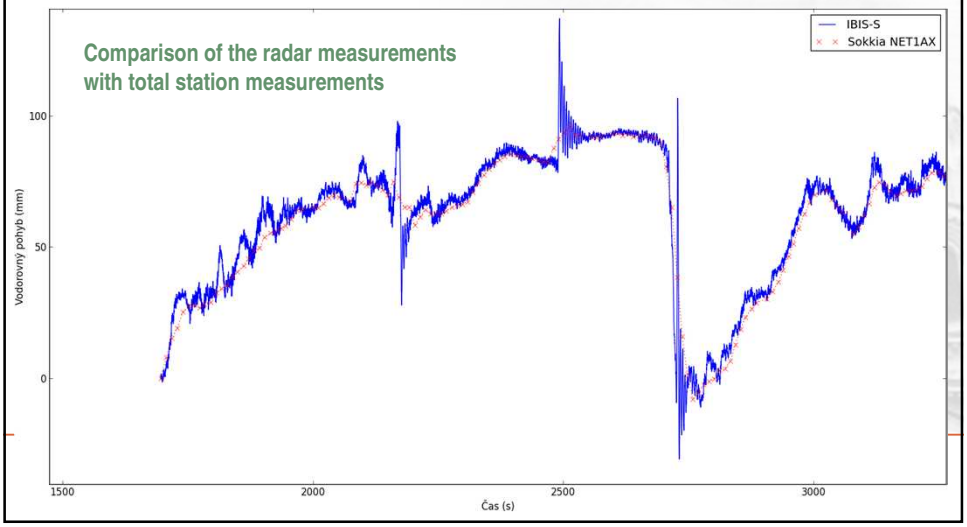

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This contribution was supported
by the Ministry of Industry and Trade of the Czech Republic,
project:

Investigation of terrestrial InSAR efficiency for deformation analysis of hazardous objects and localities
FR-TI4/436

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Thank you for your attention

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