



3D Model Creation of Hydro-Technical Structures

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Main topics ...

- 3D model – possible way of water flow management, design and control of structures,
- reconstruction of the structures with the aim to have optimal operation parameters,
- measurement effectiveness - according to the level of the used technology (instrumentario),
- presentation of models created from two different data sets produced by fully different ways,
- quality of the model.

Slovakia power plants



Ladce HPS - 1936



HPS Ladce

- HPS Ladce – 1936,
- the flowing capacity of this HPS is limiting for the HPS build up and down of the HPS Ladce,
- reconstruction of the structures was made with the aim to have optimal operation parameters of all structures,
- resulting the CAD analysis was designed the new turbine for the old structures of the HPS Ladce,
- 3D model is needed for this analysis.

Data acquisition, implementation



- 3D model (form, figure) determination of concrete structures located over and under the turbine,
- data acquisition by geodetic measurement,
- 3D model creation by CAD software,
- model implementation to the software used for the turbine design



Measurement and data acquisition

- measurement conditions,
- instrumentation,
- measurement framework (micro-net), two parts – over and under the turbine,
- implementation of measurements,
- mathematical model, transformation,
- 3D coordinates of measured points

Measurement conditions



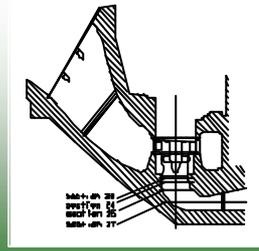
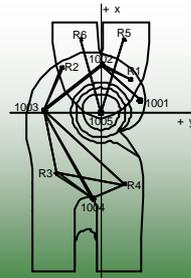
- **measurement conditions :**
 - dim lighting inside the objects,
 - sleek concrete surface with a small number of little cracks,
 - special form of objects ,
- **special instrumentation:**
 - Zeiss THEO020B with zenith ocular and lighting equipment,
 - Leica DISTO,
 - Laserfix QUADRIGA II,
 - polar method.



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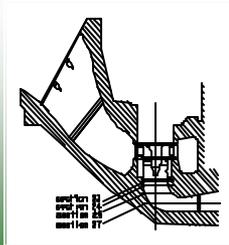
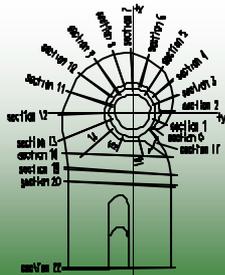
Micro-net



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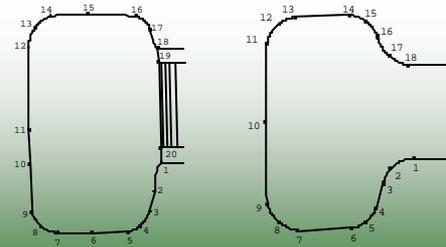
Sections



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3D model creation



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3D model creation



- 3D model creation in MicroStation, product of Bentley System, Inc.
- "dressing" of the object surfaces by water causes a change in form,
- the object's cannot be approximated by the primary designed surfaces (with constant curvature) from the original drawing,
- B-spline surface (with alternating curvature) was composed,

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3D model creation

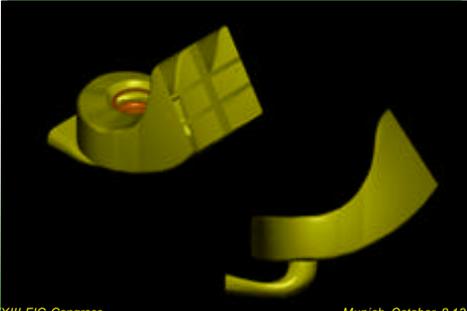


- implementation of the measured sections (polynomials) to the 3D drawing,
- substitution of sections by the set of B-spline lines,
- coating surfaces creation (B-spline surfaces) by tolerance of 10 mm,
- model viewing (visualisation).
- **model usage**

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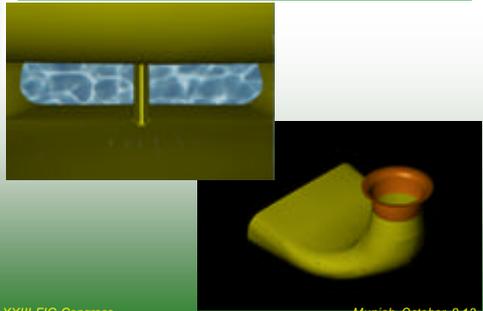
Model visualisation



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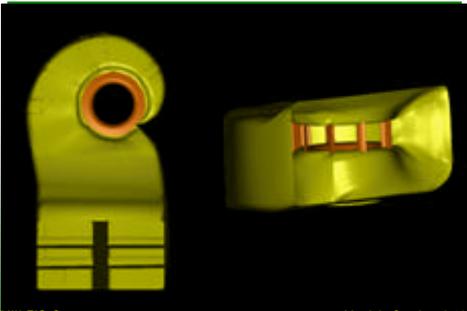
Model visualisation



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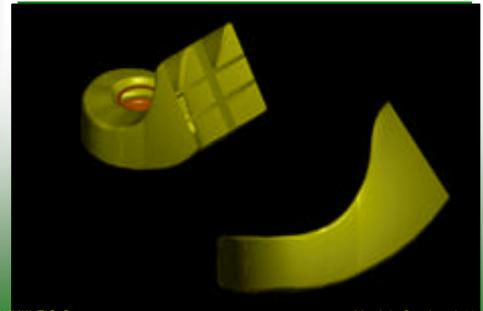
Model visualisation



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Model visualisation



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Model visualisation



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Slovakia power plants

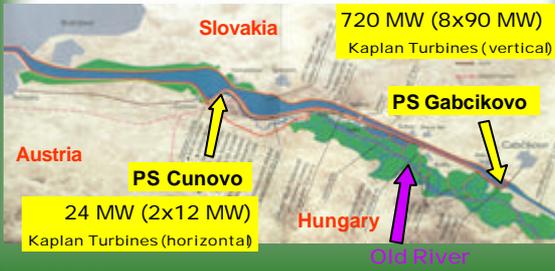


Gabčíkovo HPS

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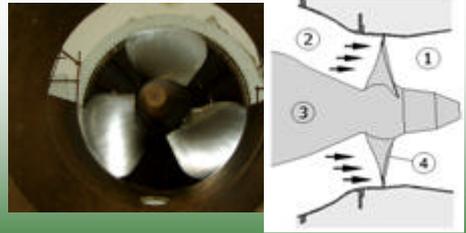
HPS System Gabčíkovo-Cunovo



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Turbine type and parameters



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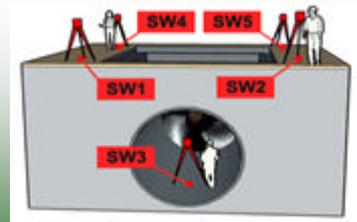
HPS Cunovo – Turbine Scanning



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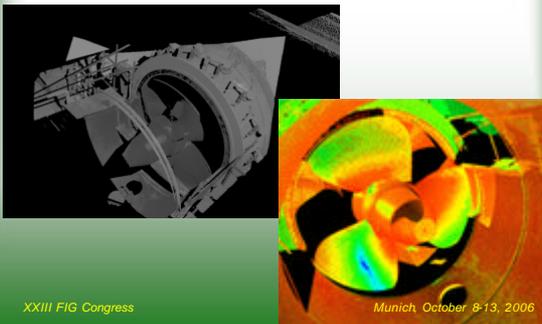
Scanning Stations



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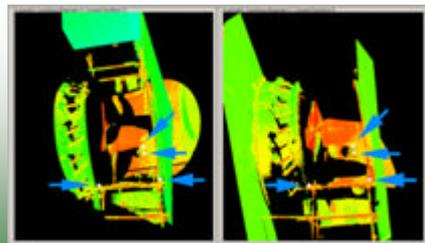
Point Cloud



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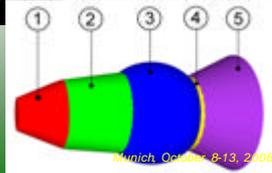
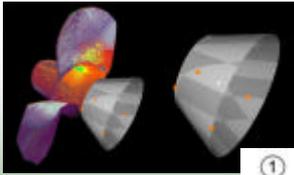
Determination of identical points



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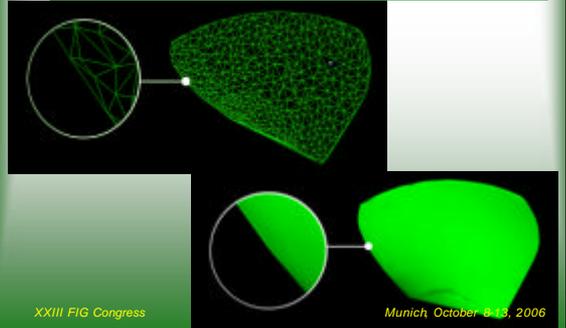
3D model



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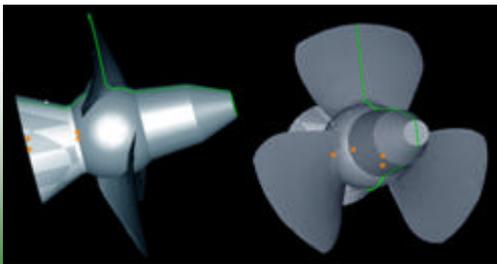
3D model



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Cyclone Model



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Conclusion



- fully different instrumentation,
- polar method,
- different measuring frame:
 - micro-net,
 - identical object points,
- comparable model quality with standard deviation of model points 5-10 mm,
- different software background,
- different effectiveness of data acquisition.

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