



WROCLAW UNIVERSITY OF ENVIRONMENTAL AND LIFE SCIENCES

# MODERN TECHNOLOGIES IN RESEARCH AND EDUCATION AT THE INSTITUTE OF GEODESY AND GEOINFORMATICS

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**Institute of Geodesy and Geoinformatics**

# OUTLINES

1. GEO-INFO-HYDRO center
2. Laboratory of Geodetic Technology
3. Laboratory of Remote Sensing, Laser Scanning and 3D Modeling
4. Geodetic Monitoring Laboratory
5. Applications in teaching process
6. Research applications

## GEO-INFO-HYDRO center

Project co-financed by the European Union:  
European Regional Development Fund - Infrastructure and Environment  
Programme, Priority XIII, Application 13.1.



*Visualization of  
GEO-INFO-HYDRO building*



*Visualization of  
GEO-INFO-HYDRO building*



*Localization of GEO-INFO-HYDRO building  
on the map of University campus*

## GEO-INFO-HYDRO center

- the total value of the project: 56 092 785.50 PLN
- the amount of expenditure qualified: 56 056 261.96 PLN
- the EU contribution: 47 647 822.67 PLN
  
- educational area: 4575,8 m<sup>2</sup>
- additional area: 3208,7 m<sup>2</sup>
  
- 6 floors, 2 elevators, parking
- laboratories, offices, seminar rooms, library, reading rooms, rooms for staff and PhD students, student social rooms



*GEO-INFO-HYDRO building*



UNIA EUROPEJSKA  
EUROPEJSKI FUNDUSZ  
ROZWOJU REGIONALNEGO



# GEO-INFO-HYDRO center

## Laboratories



*Laboratory located in GEO-INFO-HYDRO building*



*Technical room*

# Laboratory of Geodetic Technology

## Geodetic instruments



*Trimble S8 0,5" HP  
Robotic Total Station  
Model instrument to  
measure:*

- distances
- angles



*Trimble S8 1" DR PLUS  
Robotic Total Station  
Model instrument to  
measure:*

- distances
- angles



*Trimble DiNi 0,3  
Precise code level  
Model instrument to  
measure height  
differences*



*Leica MS50  
Robotic Multistation*

# Laboratory of Geodetic Technology

## Geodetic instruments testing stations



*Collimator stations  
Desinged to control  
geodetic instruments.  
Using collimators to  
determine axial  
conditions of theodolites,  
total stations and levels*

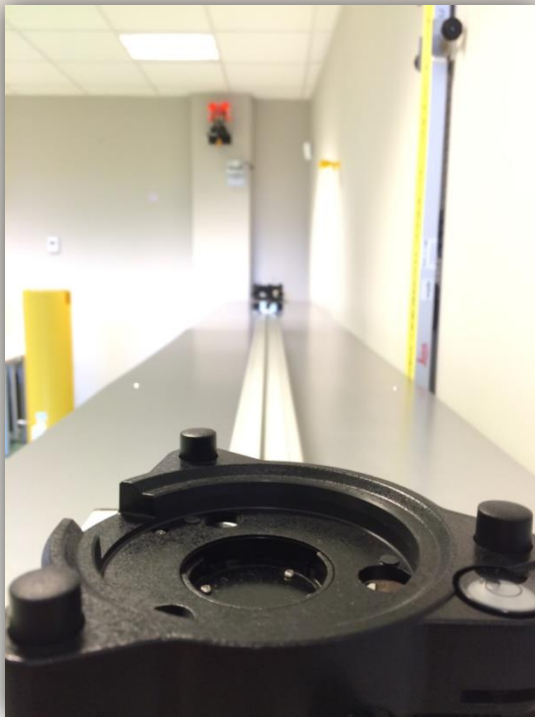
*Leica service station used  
for testing and  
examination measuring  
instruments*



*Determining instruments  
errors, defining  
corrections, controlling  
axial conditions*

# Laboratory of Geodetic Technology

## Geodetic instruments testing bases



*Longitudinal datum – to control accuracy of distances measurements – using laser interferometer*



*Precise level staffs installed in the laboratory*



*Vertical comparator of leveling staff – designed to control height differences heights measurements and accuracy of leveling staffs. Using laser interferometer LS10.*



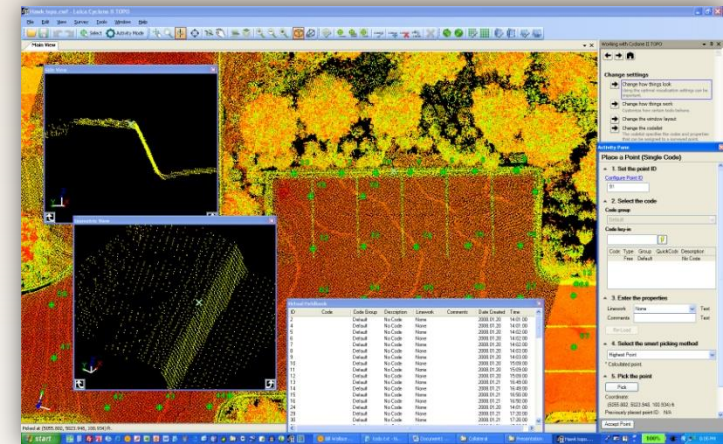
# Laboratory of Remote Sensing, Laser Scanning and 3D Modeling

## Scan stations



*Leica ScanStation C10 includes a high-accuracy/long-range scanner, tilt sensor, battery, controller, data storage, auto-adjusting video camera and laser plummet*

*Leica ScanStation P20  
high speed scanner*



*Leica Cyclone –software modules provide point cloud users with the widest set of work process options for 3D laser scanning projects in engineering, surveying, construction and related applications*

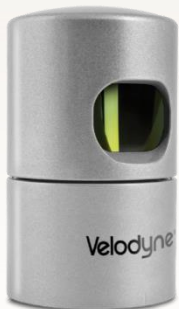
# Laboratory of Remote Sensing, Laser Scanning and 3D Modeling

## Airborne teledetection

GNSS - OEM615 Novatel



Nikon D800



*Aibot X6 – photogrammetric drone equipped with Velodyne laser scanner, IR camera, GPS receiver, gyroscope, accelerometer, barometer, magnetometer, ultrasonic sensors*

# Laboratory of Remote Sensing, Laser Scanning and 3D Modeling

## Kinematic measurements



*Applanix220 LV is a compact, fully integrated, turnkey position and orientation system, utilizing integrated inertial technology to generate stable, reliable and repeatable positioning solutions for land-based vehicle applications*

# Laboratory of Remote Sensing, Laser Scanning and 3D Modeling

## Software

- ArcGIS
- Leica Cyclone
- ENVI
- SarScape
- 3D Reshaper



**3D RESHAPER®**  
The 3D scanner software



# Geodetic Monitoring Laboratory

## Geodetic sensors



Leica Robotic Total Station TS50

Accuracy of angle measurement - 0,5" Designed to monitoring systems



Leica Robotic Total Station TM50



Leica AR10 GNSS Antenna



Leica GR25 GNSS Receiver

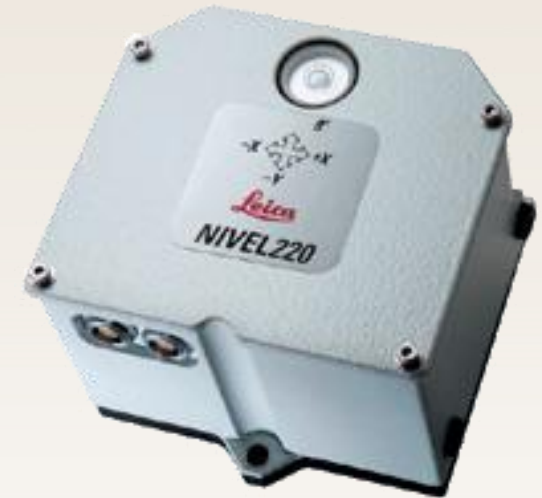
# Geodetic Monitoring Laboratory

## Other sensors



*Tiltmeter KELAG SCA124T  
Measuring tilt in real time  
Range - +/- 30 degrees  
Resolution – 0,03 degree  
Installed in inclinometer tube*

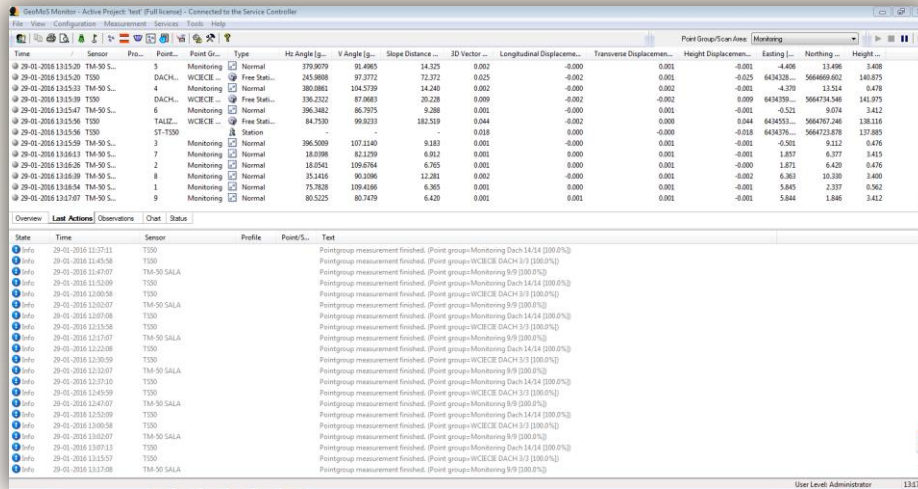
*Vaisala WXT520  
meteorological station  
measuring:  
-temperature  
-barometric pressure  
-humidity  
-wind speed  
-wind direction  
-precipitation*



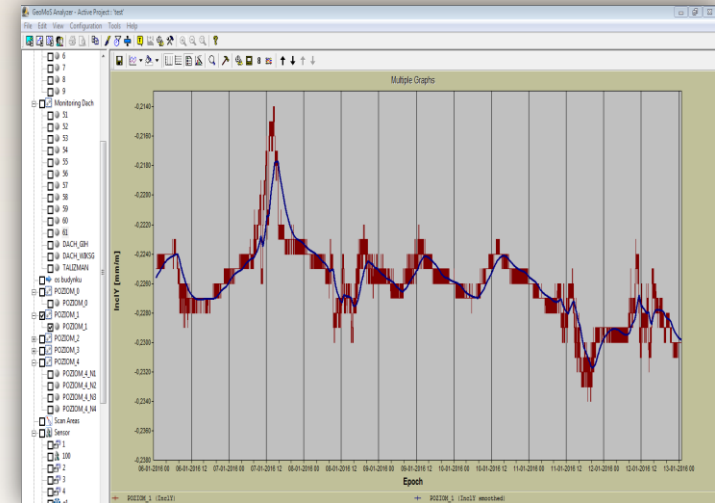
*Precise inclinometer – Leica  
Nivel220 precision inclination  
sensor for simultaneous  
measurement of inclination,  
and temperature with resolution  
to 0,001 mrad (0,6cc) and  
accuracy to +/- 0,0047 mrad (3cc)*

# Geodetic Monitoring Laboratory

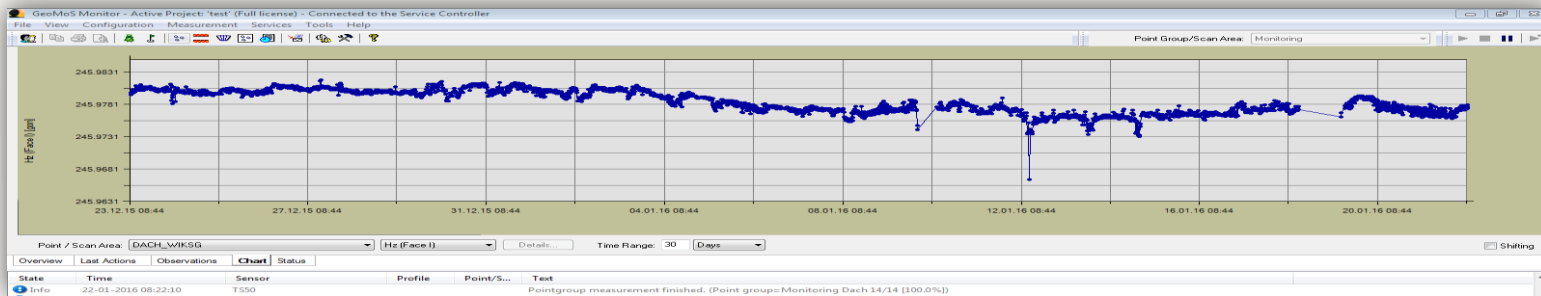
## Software



Leica GeoMoS – Monitor – sensor control



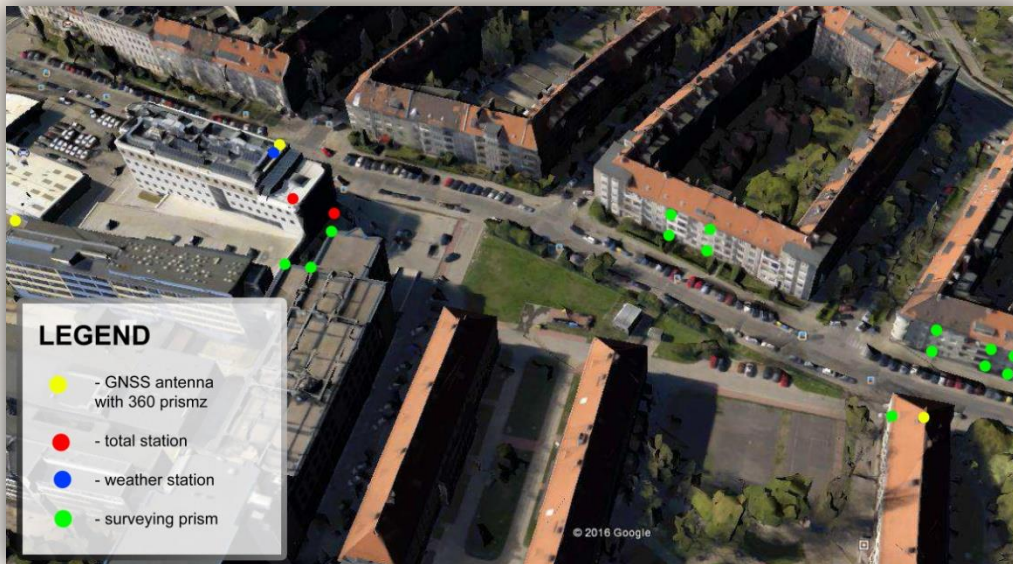
Leica GeoMoS – Analyzer – chart



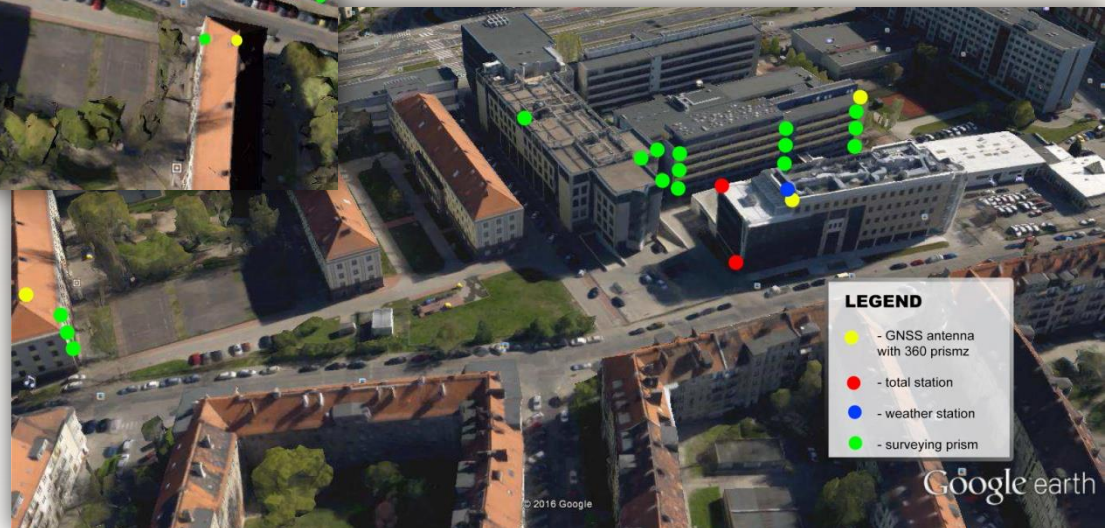
Leica GeoMoS – Monitor – chart of measured horizontal angle

# Geodetic Monitoring Laboratory

## System configuration



*Leica GeoMoS – sensor location  
Surroundings of GEO-INFO-HYDRO building  
-University buildings  
- private buildings*



*Leica GeoMoS – sensor location  
-GNSS antenas  
-Total stations  
-Meteorological station  
-prisms*



# Geodetic Monitoring Laboratory

## System configuration



*Leica GeoMoS – sensor location – GEO-INFO-HYDRO building*

## Applications in teaching process

### Existing courses:

- Satellite Geodesy
- Satellite Navigation
- Digital Photogrammetry
- Engineering Surveying

### New courses:

- Laser Scanning Technology
- UAV Systems in Geodesy

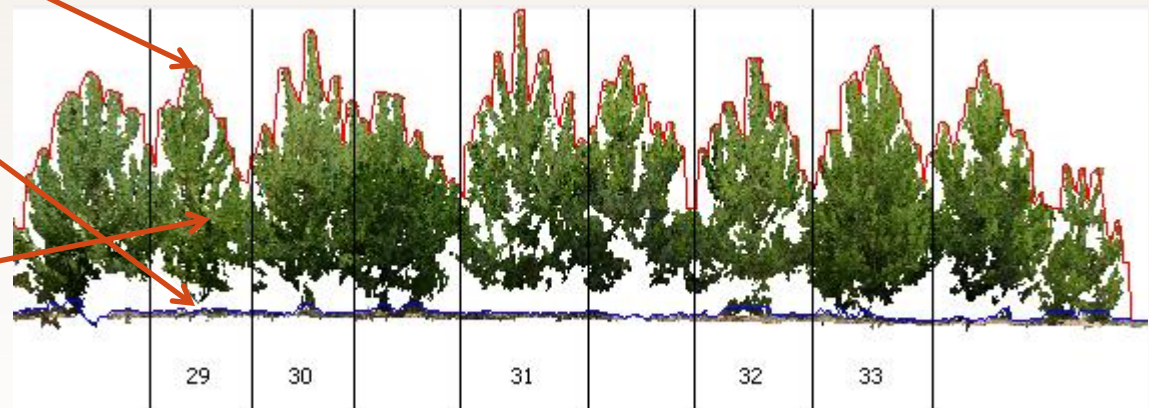
## Research applications: canopy growth assessment



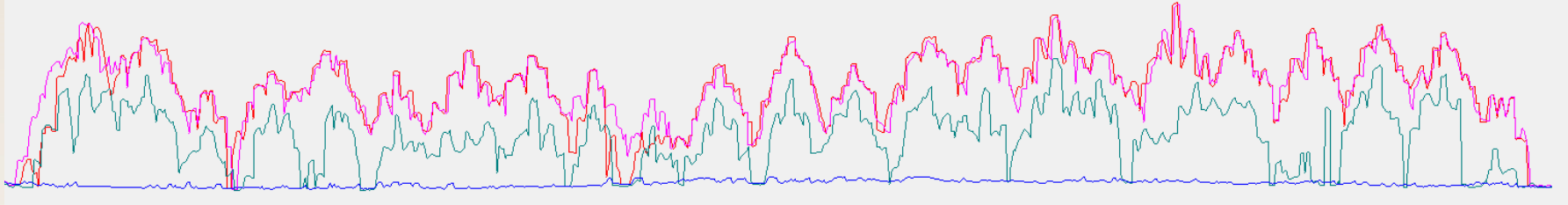
$MaxH(\text{Points})$

$AvgH(\text{Ground})$

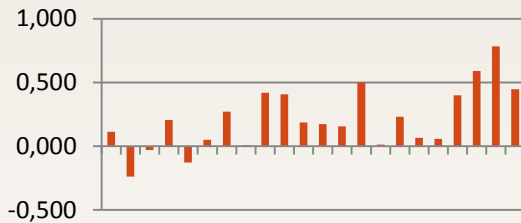
$H = \text{Max} - \text{Avg}$



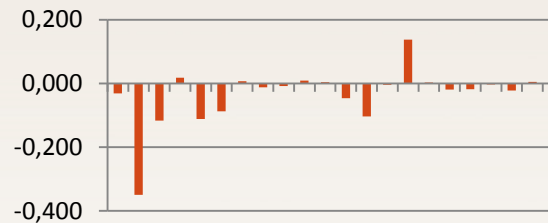
# Research applications: canopy growth assessment



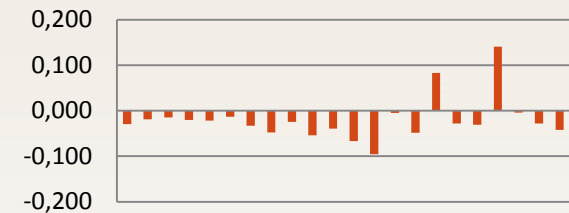
15.05.15



26.06.15

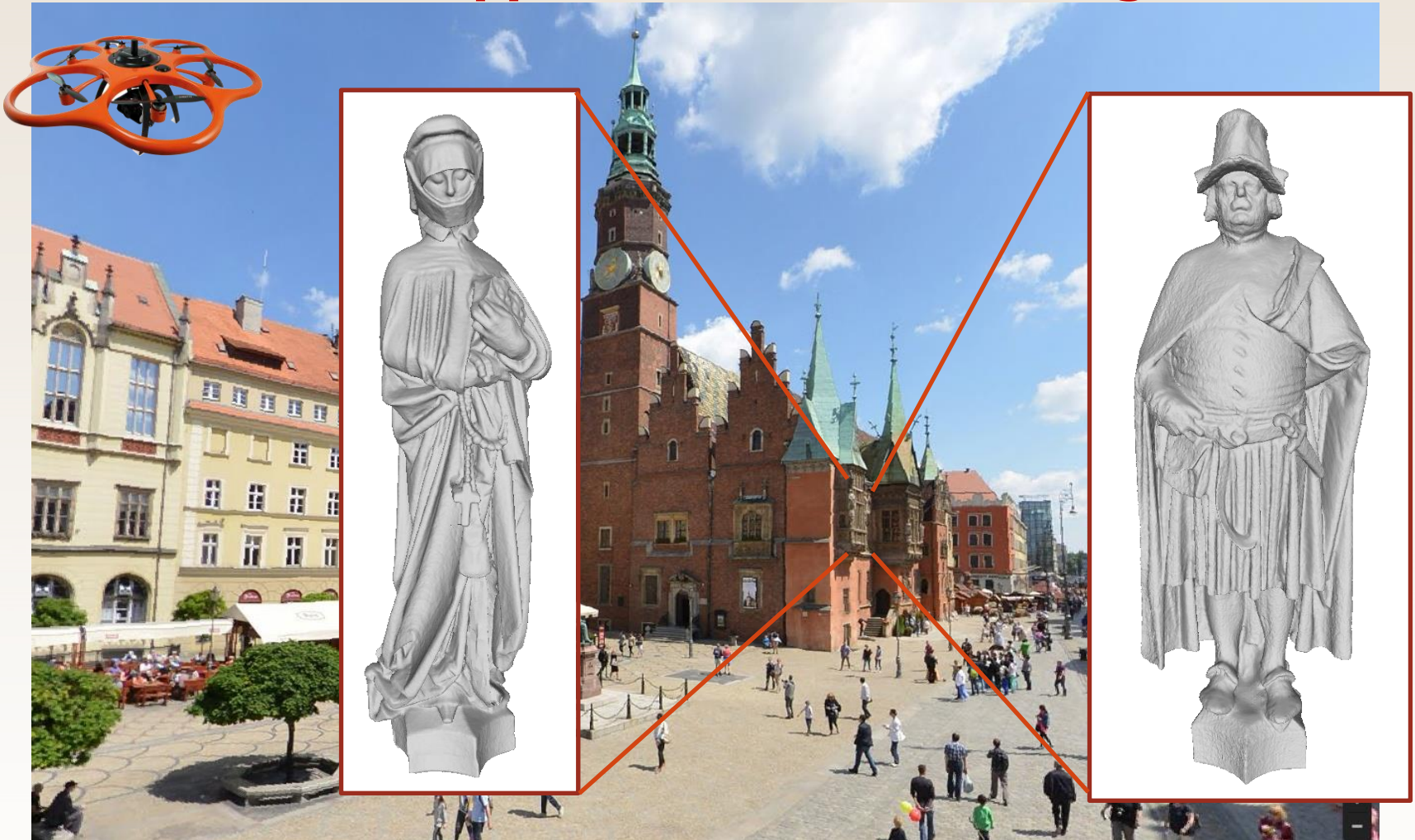


3.07.15



|       | 15.05.2015 | 26.06.2015 | 3.07.2015 |
|-------|------------|------------|-----------|
| max   | 0,784      | 0,137      | 0,140     |
| min   | -0,239     | -0,350     | -0,096    |
| sigma | 0,246      | 0,089      | 0,048     |
| MEAN  | 0,213      | -0,035     | -0,020    |
| RMSE  | 0,321      | 0,093      | 0,051     |

## Research applications: 3D modelling

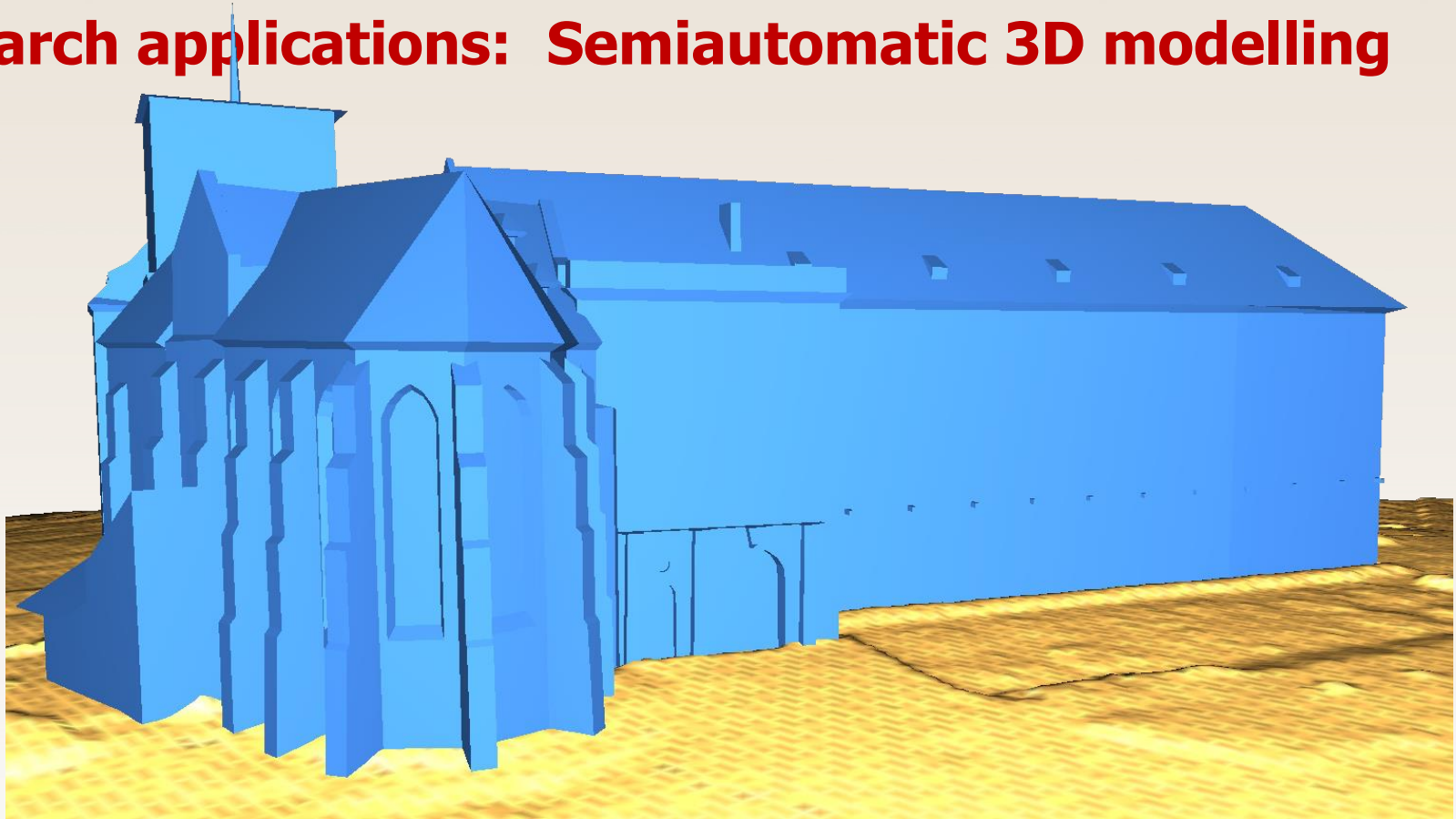


## Research applications: Semiautomatic 3D modelling



**TLS + ALS point cloud**

## Research applications: Semiautomatic 3D modelling



## Research applications: Semiautomatic 3D modelling





## Research applications: photogrammetric mobile mapping



- **Applanix 220 LV**
- **Ladybug 360 Video Spherical Camera**

**Thank You For Attention !**

