ETH*zürich*

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Comparison of Three Innovative Technologies for 3D-Acquisition, Modelling and Visualization of an Underground Mine

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Introduction

- Challenge of mapping large-scale environment with:
  - high surface complexity
  - high level of detail
  - low ambient light

- Technological solutions:
  - integrated geodetic solutions and systems

- Study case: Gold Mine of Sessa (CH):
  - diameter: ~ 1.5 – 3 m
  - length: ~ 350 m

Instruments

| Faro Focus3D X 330	Leica Pegasus:Backpack	GeoSLAM ZEB-REVO
Terrestrial Laser Scanner	Mobile Mapping System	Handheld Laser Scanner
9 hours 5064 million points	10 minutes 26 million points	15 minutes 27 million points

© FARO

© Leica

© GeoSLAM

Goals

- Empirical comparison with the focus on:
  - acquired data quality
  - properties of derived 3D models
  - technique usability

- Visualize the obtained data

- Give recommendations for tackling similar tasks

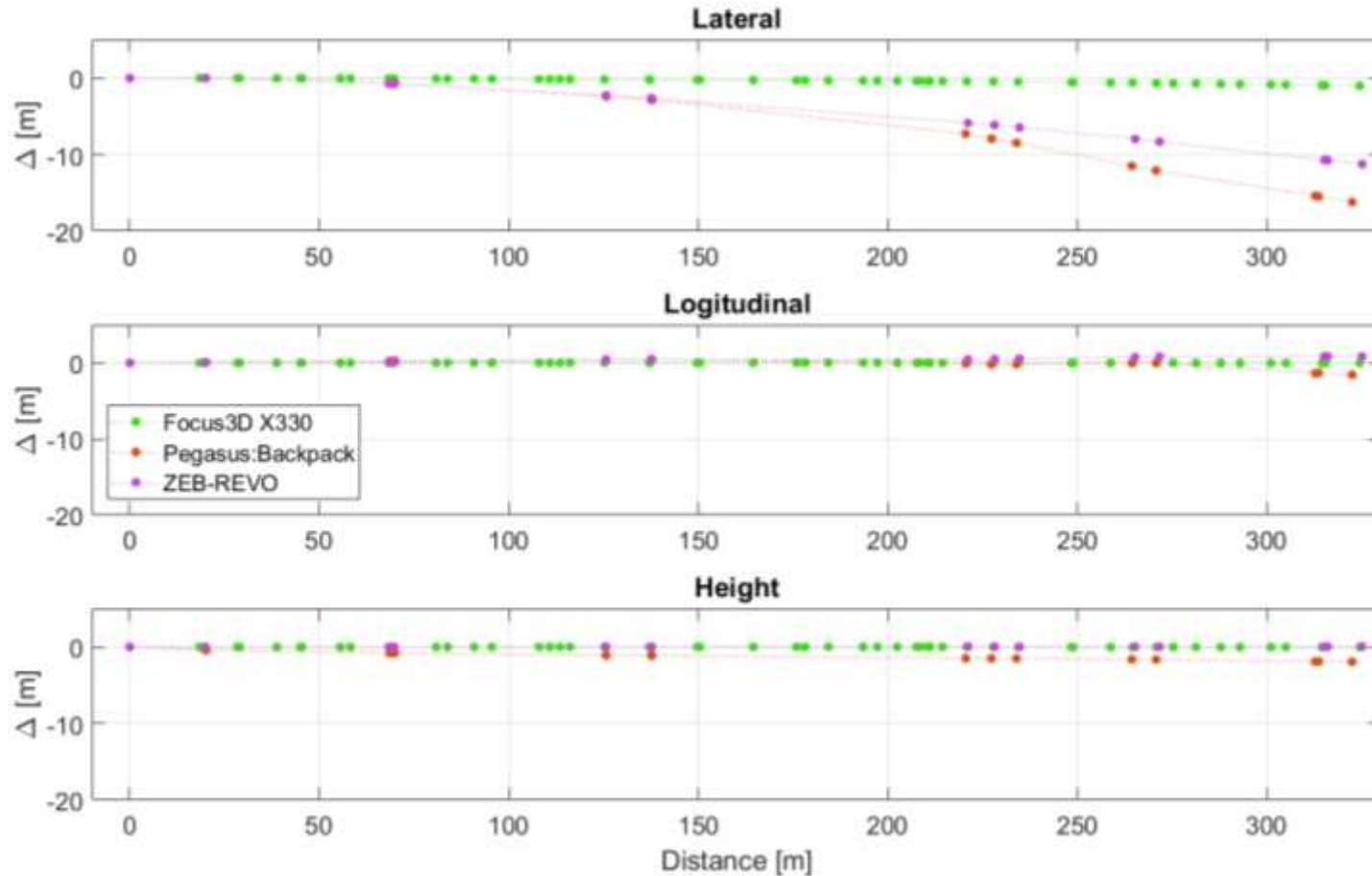# Analysis of Deviations
Bending and Scale

- Transform point clouds into a common coordinate system (2 spheres over 20 m baseline)

Legend:
- Focus3D X330
- Pegasus:Backpack
- ZEB-REVO
- ✖ Sphere for referencing

100 m
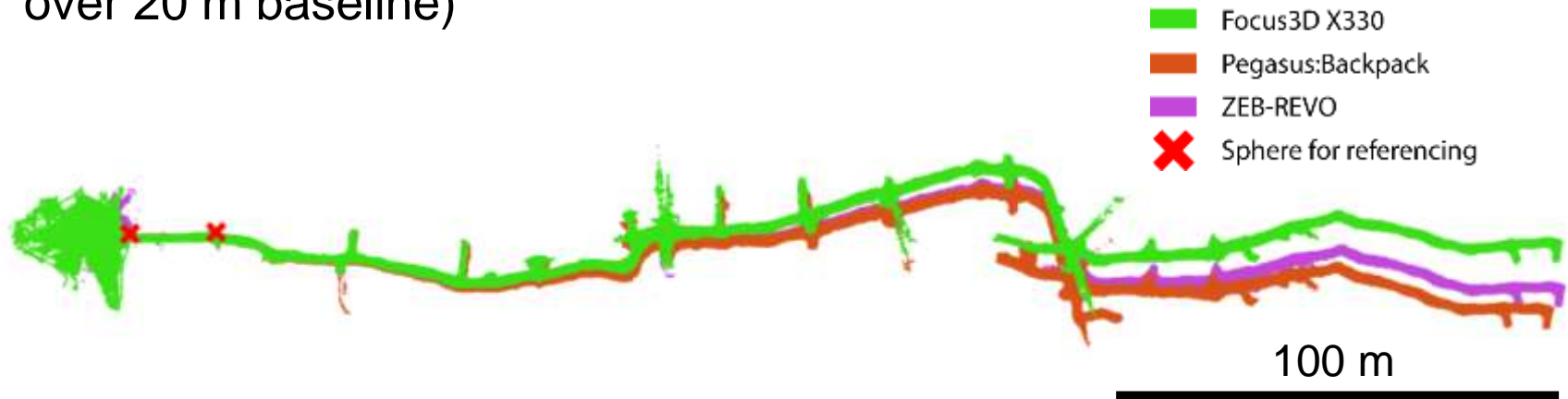
- Comparison reference: geodetic terrestrial network

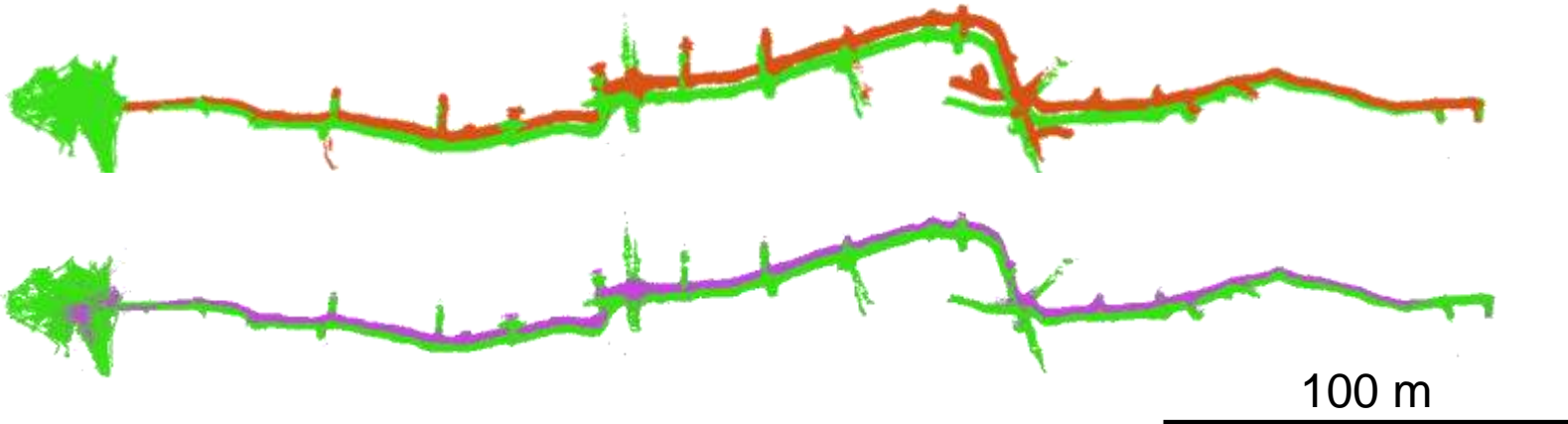- Sphere centres connected to the network points via fixed bolts

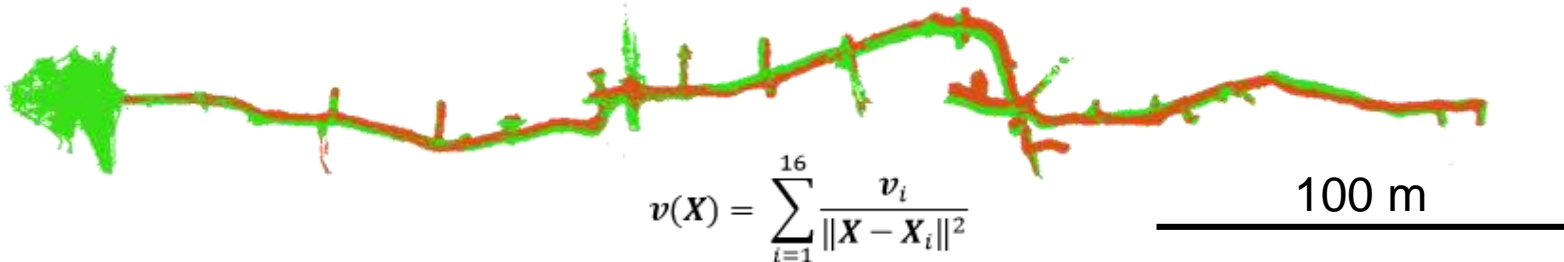# Analysis of Deviations
Bending and Scale – Comparison

Analysis of Deviations
Transformation
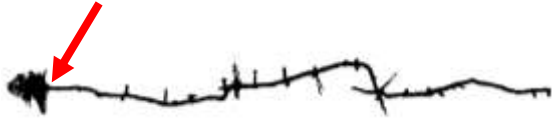
- Rigid transformation (using 6 GCPs):

100 m

- Non-rigid transformation:
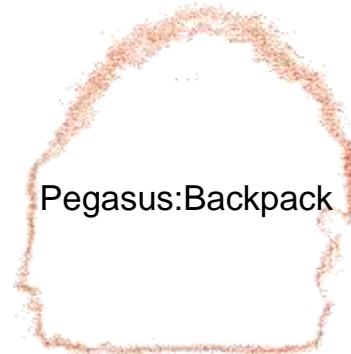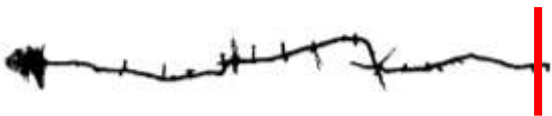

$$v(X) = \sum_{i=1}^{16} \frac{v_i}{\|X - X_i\|^2}$$

100 m

Analysis of Deviations
Noise

Sphere:
Ø 15 cm

0.15 m

Cross section
width: 5 cm

Focus3D X330
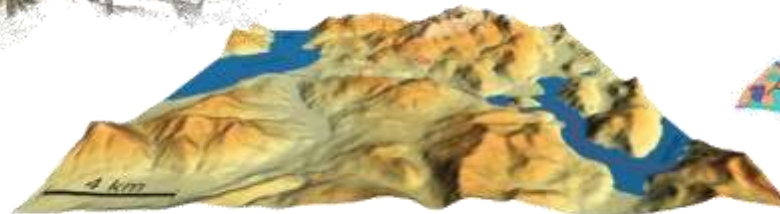
Pegasus:Backpack

ZEB-REVO

2 m

Visualization

- Gypsum 3D physical model

- Web visualization: Potree, Blend4Web, Sketchfab

- VR visualization: point cloud, mesh, geological maps and DTM

4 km

Conclusion

	Faro Focus3D X 330	Leica Pegasus:Backpack	ZEB-REVO
Pros	- Overall **the best performance**, in terms of data quality - acquisition when high data accuracy and resolution are of importance	- Very **fast acquisition** - acquisition when precision of a few cm is required - RGB information	- Very **fast acquisition** and pre-processing - acquisition when precision of a few cm is required - Handheld
Cons	- **High time consumption** for scanning - **high data complexity** and its handling	- **Lower specified precision** and lower accuracy - backpack's height when worn makes it hard to scan narrow environments	- **Lower specified precision** and lower accuracy - **no RGB** or intensity information

🌐 digitalreality.ethz.ch/goldmine/