Improving the productivity of terrestrial laser scanning in the field and in the office

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RIEGL®

RIEGL VZ®-600i

terrestrial laser scanner

RIEGL VZ-600i terrestrial laser scanner

RIEGL VZ-600i

High Productivity

- "One-Touch"-button operation
- *RIEGL* VZ-i Project Map App for scan project monitoring
- concurrent scan and image data acquisition
- Real-Time On-Board automatic registration
- "One-Touch"-Processing Wizard for automatic production of end deliverables

Ultimate Performance

- pulse repetition rate up to 2.2 MHz
- scan speed up to 420 lines/sec
- 30 sec scan time (6 mm resolution @ 10 m distance)
- high speed data download of up to 500 MB/sec

Extreme Versatility

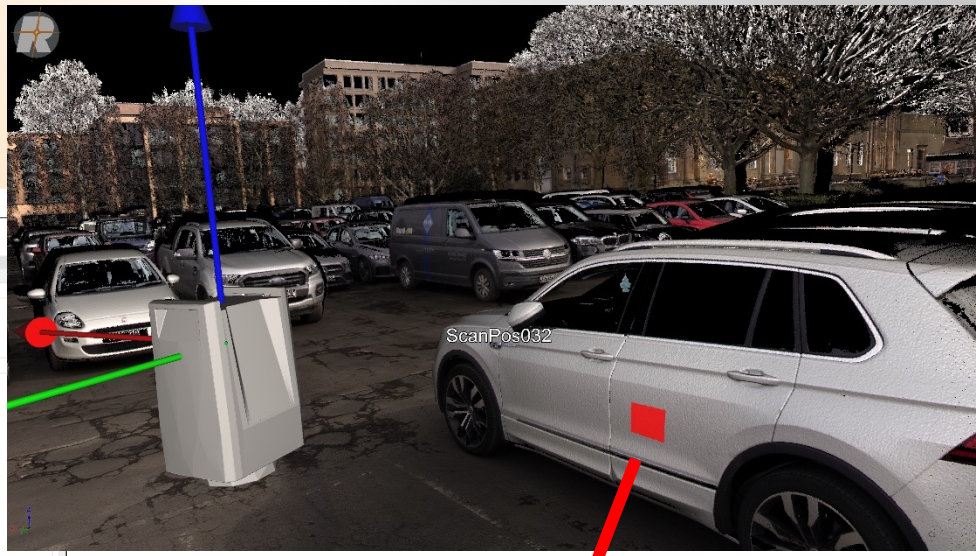
- for various applications
- indoor and outdoor 3D mapping
- short and long ranges
- lightweight (approx. 6 kg / 13 lbs)
- dual processor architecture for developing user-specific Python apps

Additional Mobility

- prepared for robotic operation integration (ROS driver available)
- option for kinematic laser scanning
- can be used with the *RIEGL* VMR Robotic Rail Scanning System
- flexible mounting platforms


grey-coded point cloud
(reflectance)


colored point cloud
(true color)



Calculation results...

Statistics | Charts | Point Attribute Statistics

Units: [m] [deg] [dB] [dB] Amplitude

NUMBER OF POINTS

Total: 13552 Valid: 13552 Rate: 100.00%

STATISTICS

	Min	Max	Max - Min	StdDev	Mean
Range:	2.59818	2.76763	0.16945	0.03495	2.67941
Amplitude:	29.75000	31.08000	1.33000	0.18515	30.41184
Reflectance:	-4.77000	-3.35000	1.42000	0.20185	-4.05577
Deviation:	0.00000	7.00000	7.00000	1.30431	1.50782
Red:	0.50980	0.60784	0.09804	0.01704	0.55579
Green:	0.50588	0.60392	0.09804	0.01719	0.55176
Blue:	0.52941	0.62745	0.09804	0.01838	0.57300

Copy

PLANE

	Min	Max	Max - Min	StdDev	Mean
Range:	-0.00307	0.00784	0.01091	0.00088	0.00000

	X	Y	Z
Plane position:	-0.16006	-2.48679	-0.98182
Plane normal vector:	0.49116	0.87017	-0.03960
Inclination angle:	34.638		

OK Cancel Help

PLANE

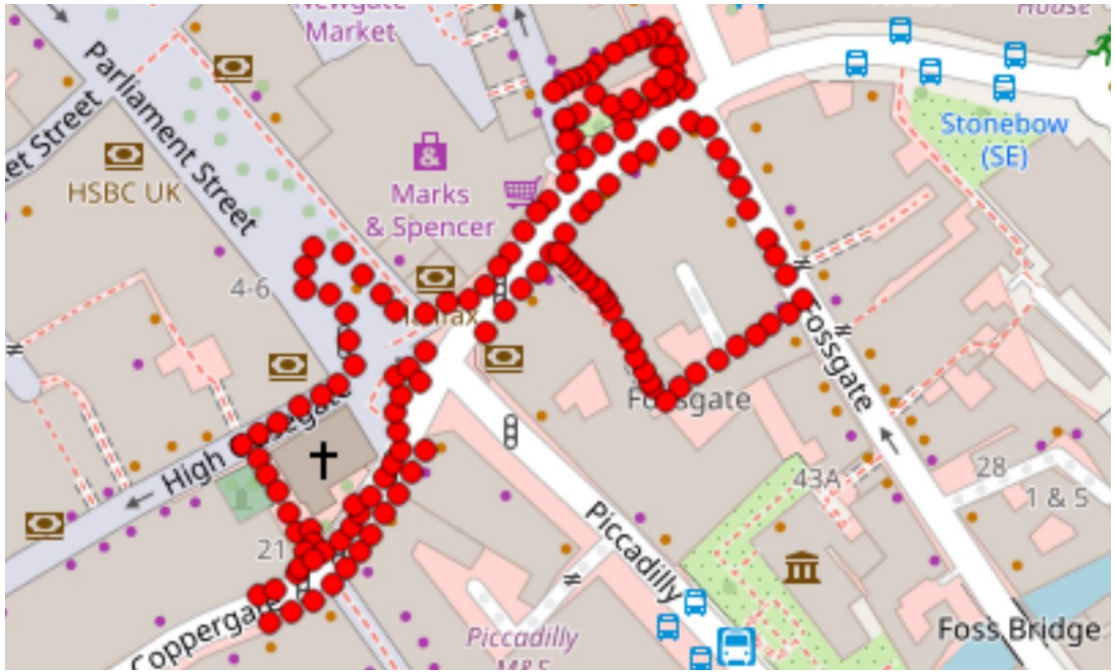
	Min	Max	Max - Min	StdDev	Mean
Range:	-0.00307	0.00784	0.01091	0.00088	0.00000

<1mm standard deviation
of selected area (13552 individual range measurements) / no averaging


colored point cloud
(true color)

York / down town

data acquistion	*RIEGL* VZ-600i
date	March 15th, 2023
time	14:22 – 16:33
Nr. of scan positions	149



York / down town

data acquistion	*RIEGL* VZ-600i
date	March 15th, 2023
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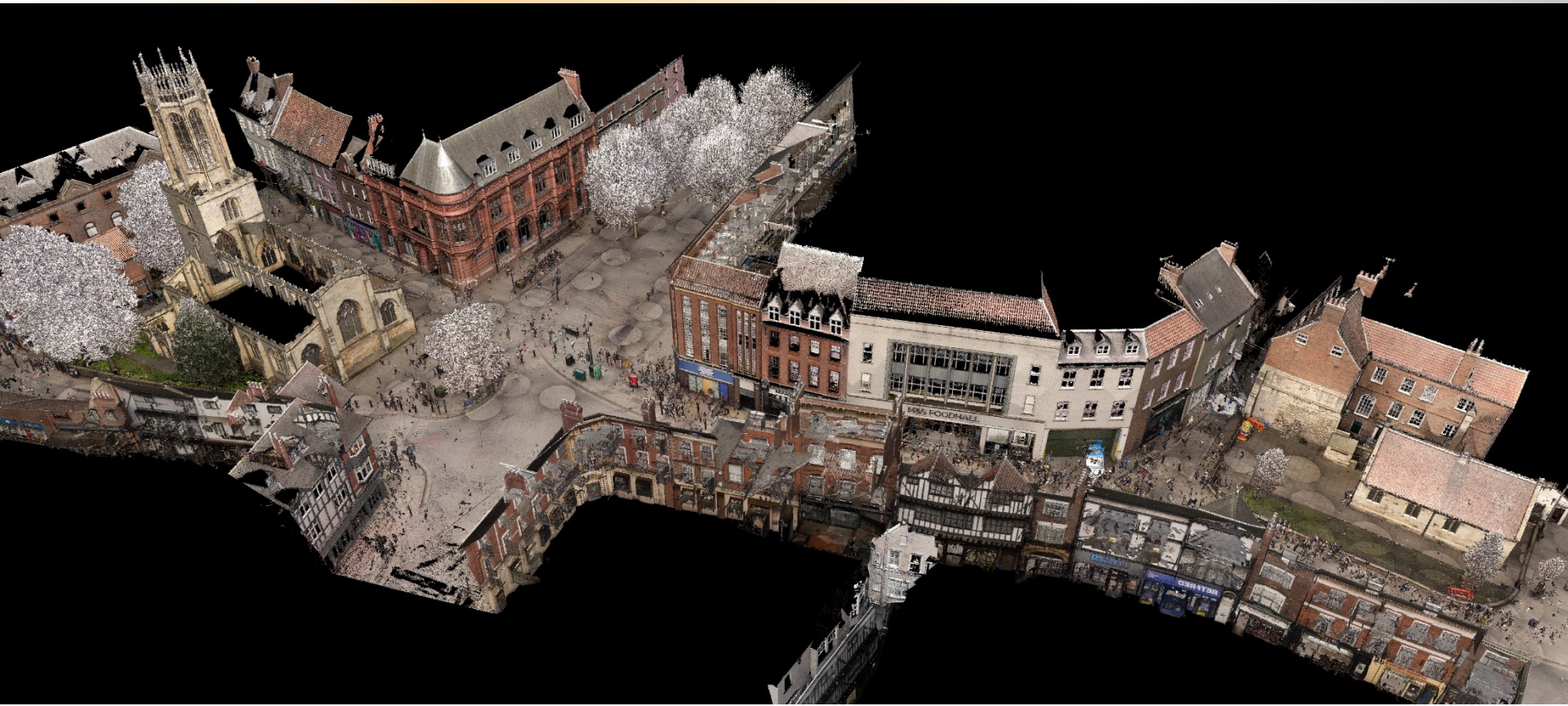
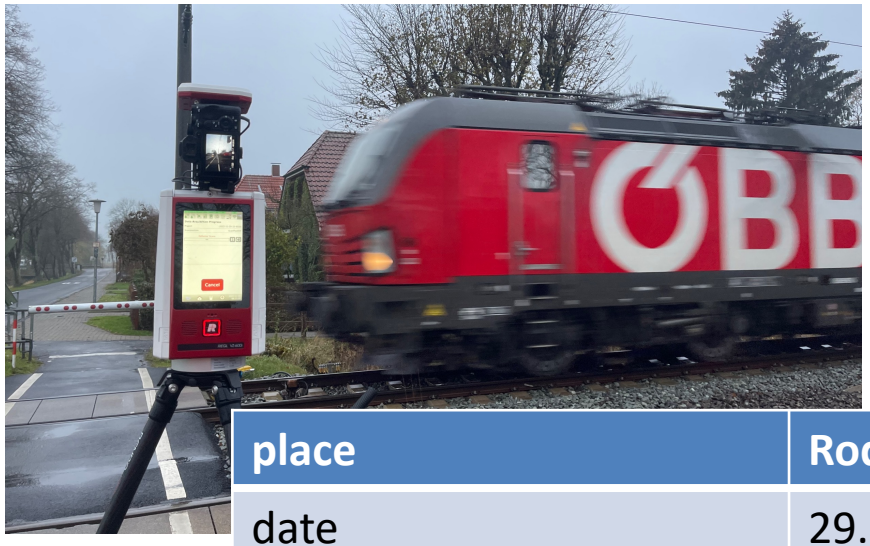
RIEGL®




BARCLAYS

RIEGL VZ-600i scan project: rail track - clearance

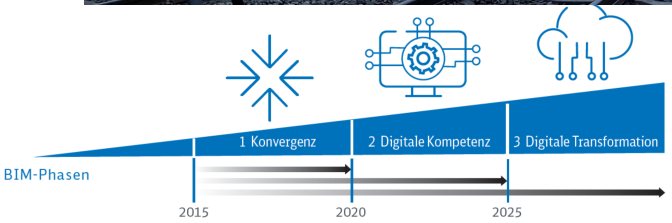


place	Rodenkirchen / Germany
date	29. Nov. 2022 (rain, 3°C)
time	07:57 – 15:33
number of scan positions	380

Rodenkirchen

RIEGL VZ-600i scan project: rail track - clearance

rail track - clearance



https://digitale-schiene-deutschland.de/de

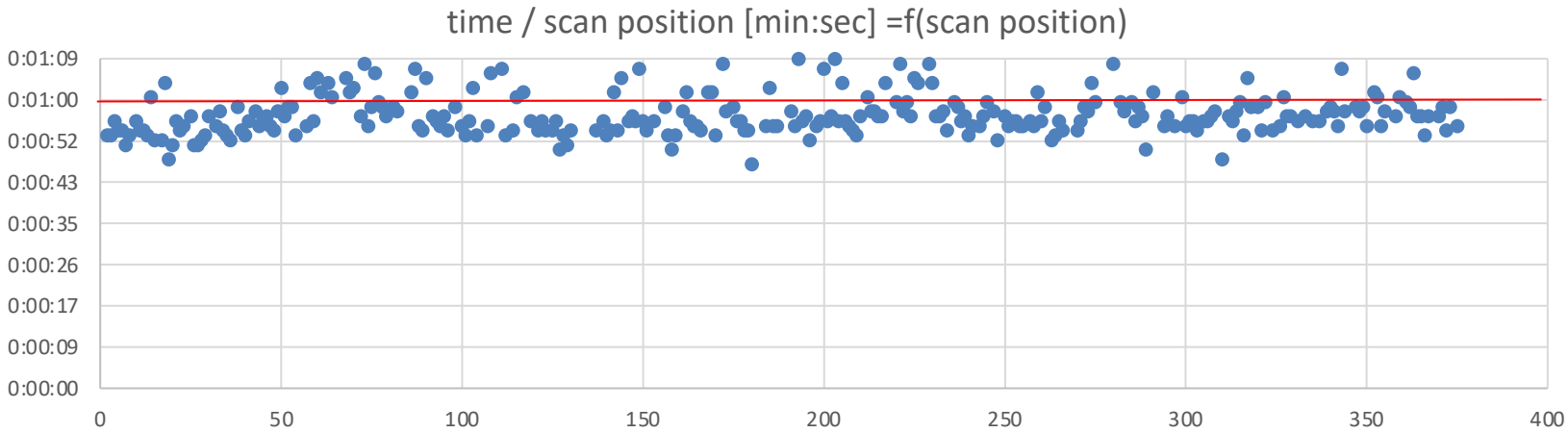
Digitale Schiene Deutschland

Die Vision der DB zur Digitalisierung von Infrastrukturanlagen der Eisenbahn basiert auf drei Segmenten:

1. Digitales Planen und Bauen
2. Digitales Anlagenmanagement
3. Digitaler Betrieb

Protection Class	**IP64, dust- and splash-proof**

rail track - clearance



Mast bolt

bi-axial reflex foil

RIEGL VZ-600i scan project: rail track - clearance

Report for Multi-Station Adjustment

Project name: **2022_11_Rink_Bahn_RSP**
Global Coordinate Reference System (GLCS): ETRS89 / Geocentric (EPSG::4936)
Report GLCS: DB_REF / 3GK zone 3 E-N (EPSG::5683)
Project origin:
Easting [m]: 3463781.7404
Northing [m]: 5917884.3601
Height [m]: 1.2973

4.4.1 Control Points in CRS#2

Control points in CRS#2 ... DB_REF / 3GK zone 3 E-N (EPSG::5683)

46 observations have been utilized on 37 control points in CRS. MSA results in the following statistics on the residuals:

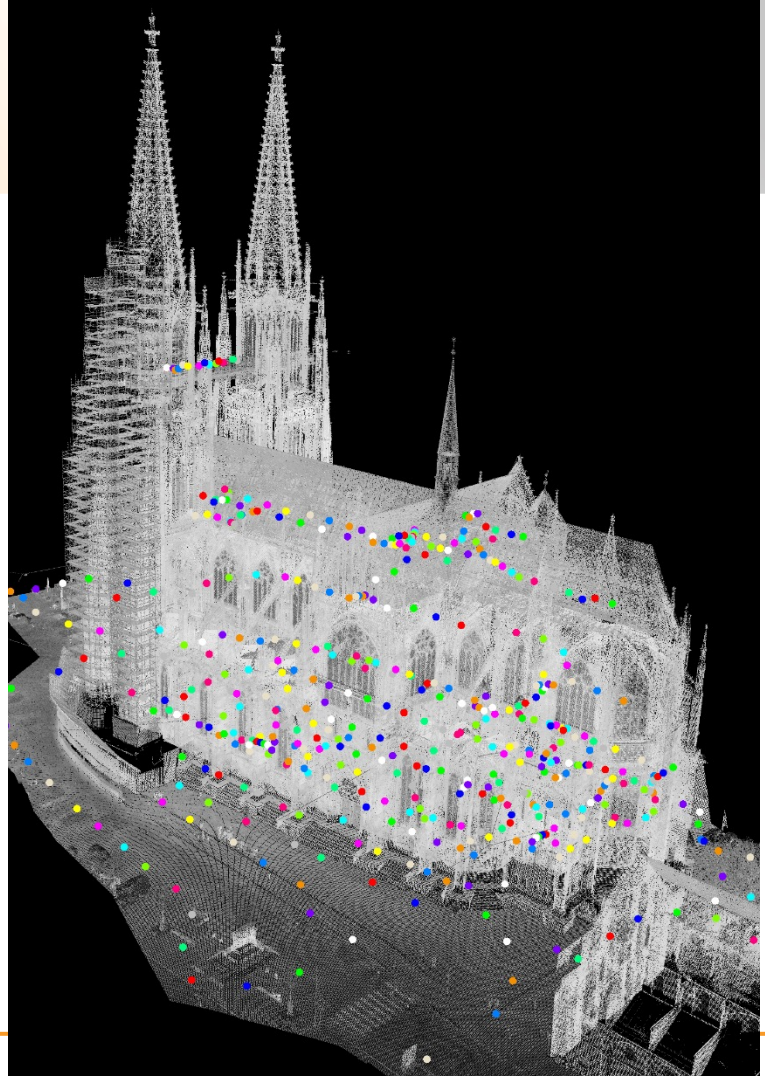
	dX [m]	dY [m]	dZ [m]	dist. [m]
Minimum deviation	-0.0197	-0.0101	-0.0330	0.0013
Maximum deviation	0.0267	0.0115	0.0386	0.0387
Mean deviation	0.0003	0.0004	0.0004	0.0130
Standard deviation	0.0091	0.0043	0.0126	---
Median abs. dev. (std)	0.0085	0.0038	0.0072	---

Rodenkirchen scan project: rail track - clearance

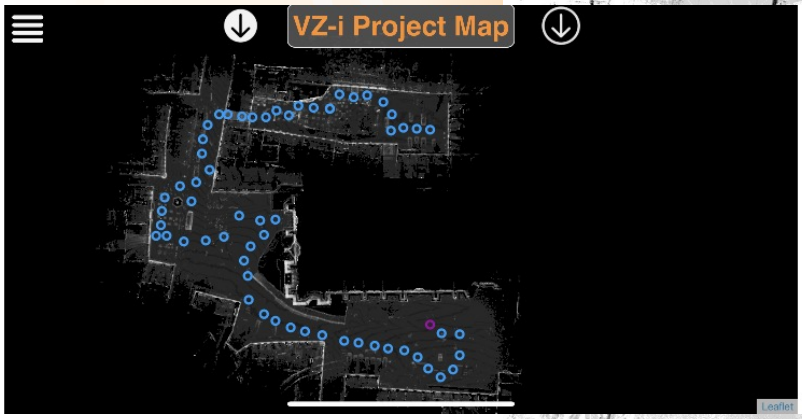
Rodenkirchen scan project: rail track - clearance

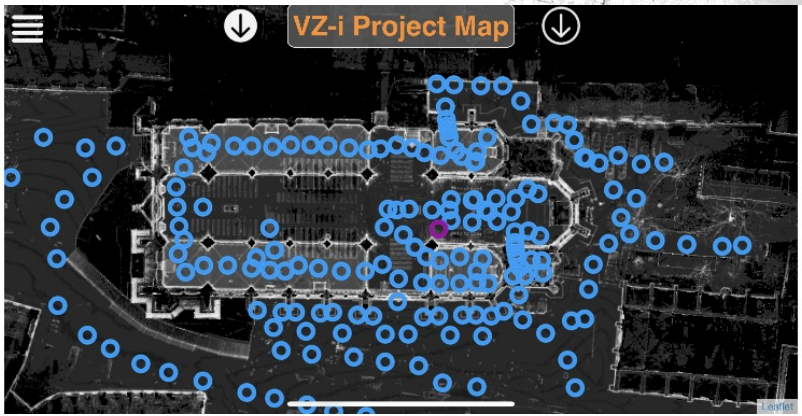
Regensburger Cathedral

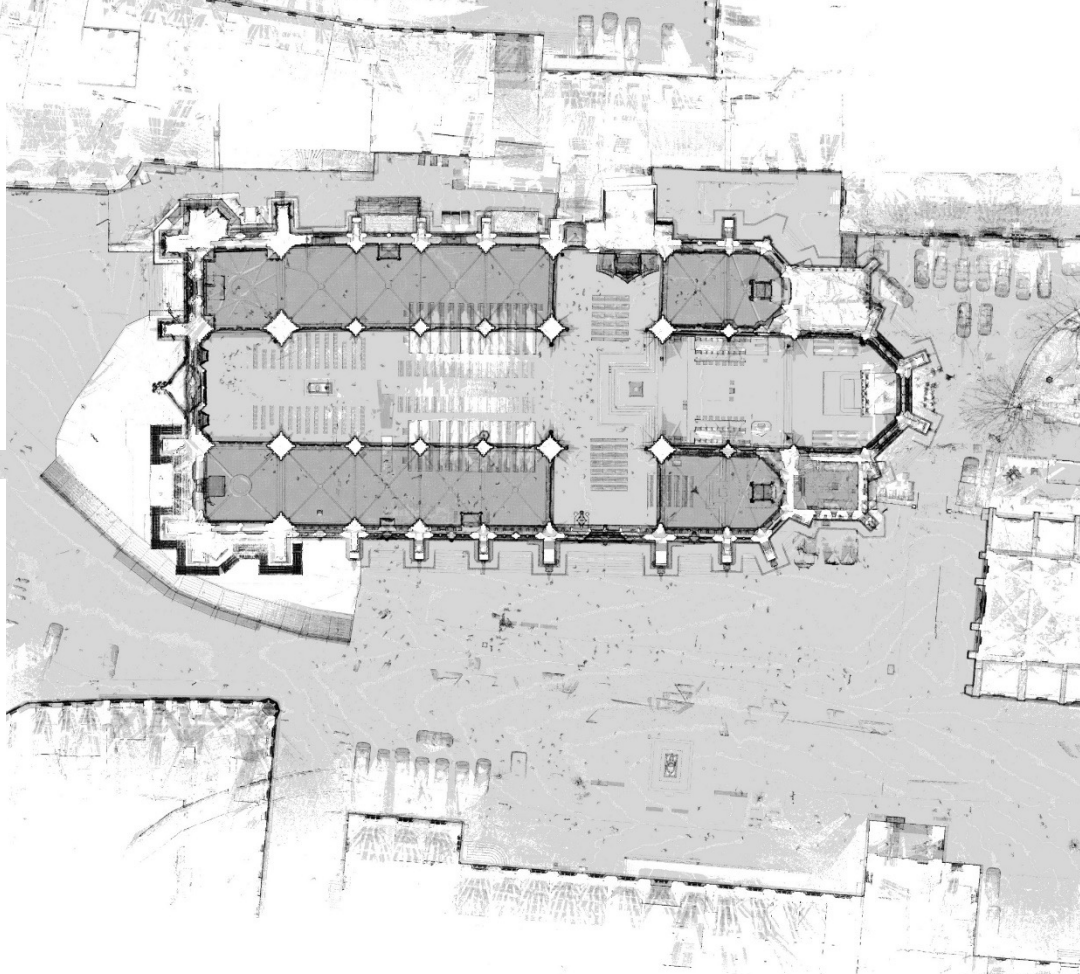
data acquisition	*RIEGL* VZ-600i laser scanner
date	20-21. March 2023
time	Mo. 11:11 – 17:12 Tu. 8:15 – 18:01
number of scan positions	501



scan positions







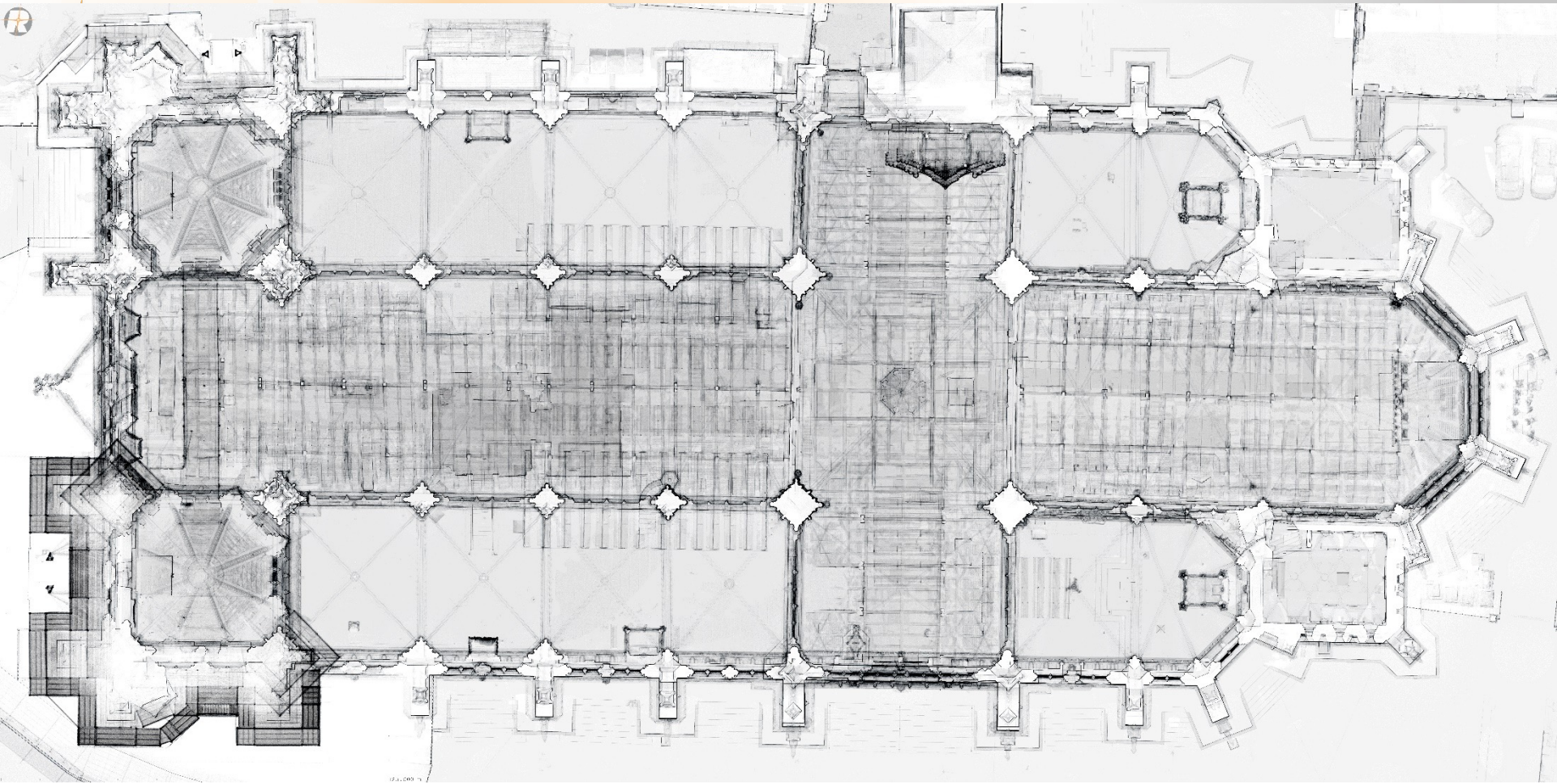
screenshot created within the laser scanner -> mobile devi

Task selection
Select the tasks to be performed

Regensburger Cathedral (1. day)

Save settings... | Load settings... | Restore defa

☐	**Task 1: Convert Scans** Convert raw RXP scan data into to RDB 2 database file format		
☑	**Task 2: Filter Scans** Keep one echo per laser shot. Delete points with a Reflectance below -20.00 dB Delete ...	100% Finished: 4m 55s 245 total, 245 succeeded	⚙
☐	**Task 3: Calculate Point Normals** Calculate a per point normal vector for lighting calculations in the 3D view		⚙
☑	**Task 4: Register Scan Positions** Register Scan Positions with Automatic Registration 2	100% Finished: 17s 241 total, 241 already registered	
☑	**Task 5: Fine Adjust Project** Adjust Scan Positions with Multi Station Adjustment 2	100% Finished: 1h 42m Succeeded	
☑	**Task 6: Calibrate Camera Mounting** Calibrate Camera Mounting by using data from first 3 Scan Positions	100% Finished: 20m Succeeded	
☑	**Task 7: Colorize Scans from Photos** Colorize Scans from Photos	100% Finished: 1h 5m 245 total, 245 succeeded	
☑	**Task 8: Mark Single Source Points** Mark points that are scanned from one Scan Position only with the "Single Source Point...	100% Finished: 1h 42m Single Source Points marked in 245 Point Clouds	⚙
☐	**Task 9: Mark Dynamic Objects** Mark points caused by dynamic objects with the "Dynamic Object Point" Point Flag		⚙
☑	**Task 10: Generate Octree based Point Clouds** Generate combined point clouds with the following resolutions: 0.010 m). "Single Sourc...	100% Finished: 48m Succeeded	⚙



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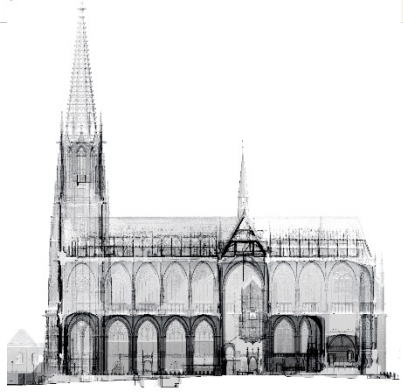
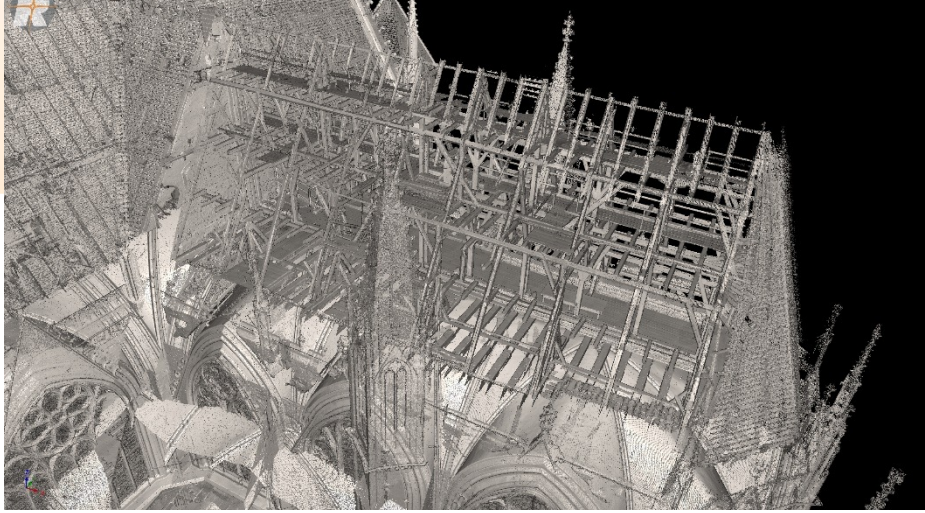
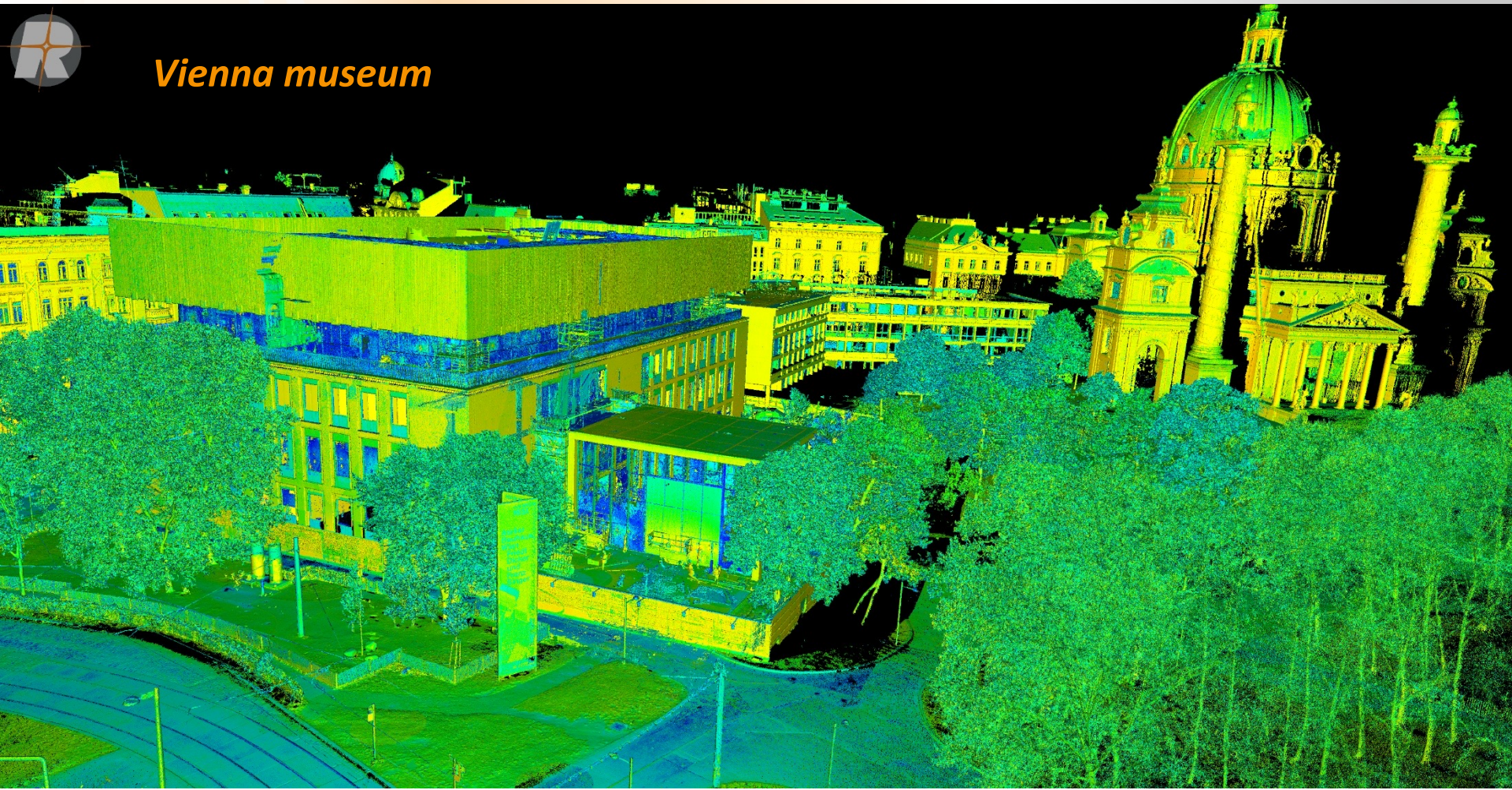
Regensburger Cathedral



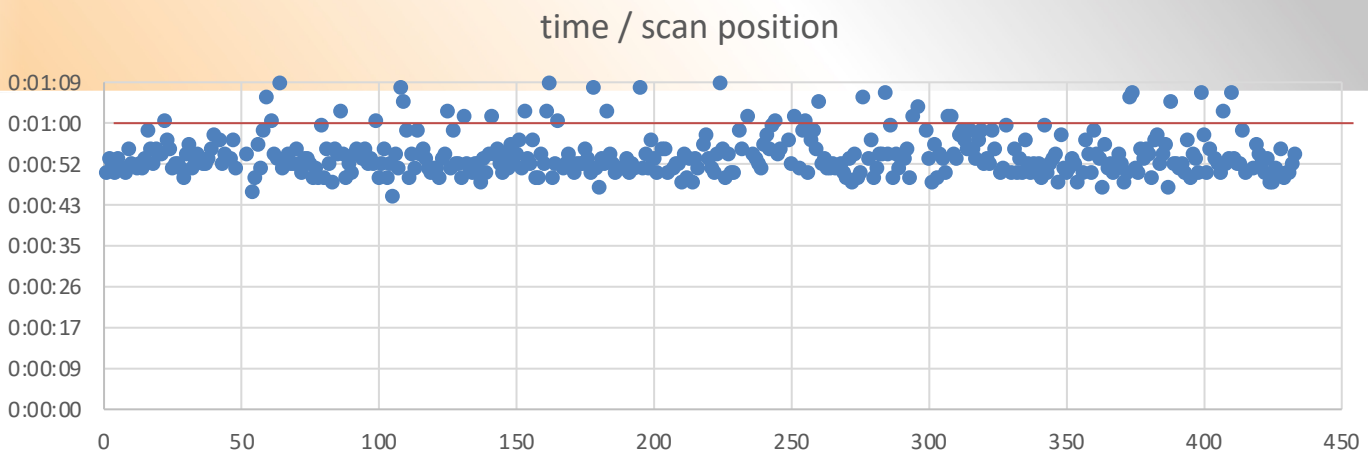


Vienna museum

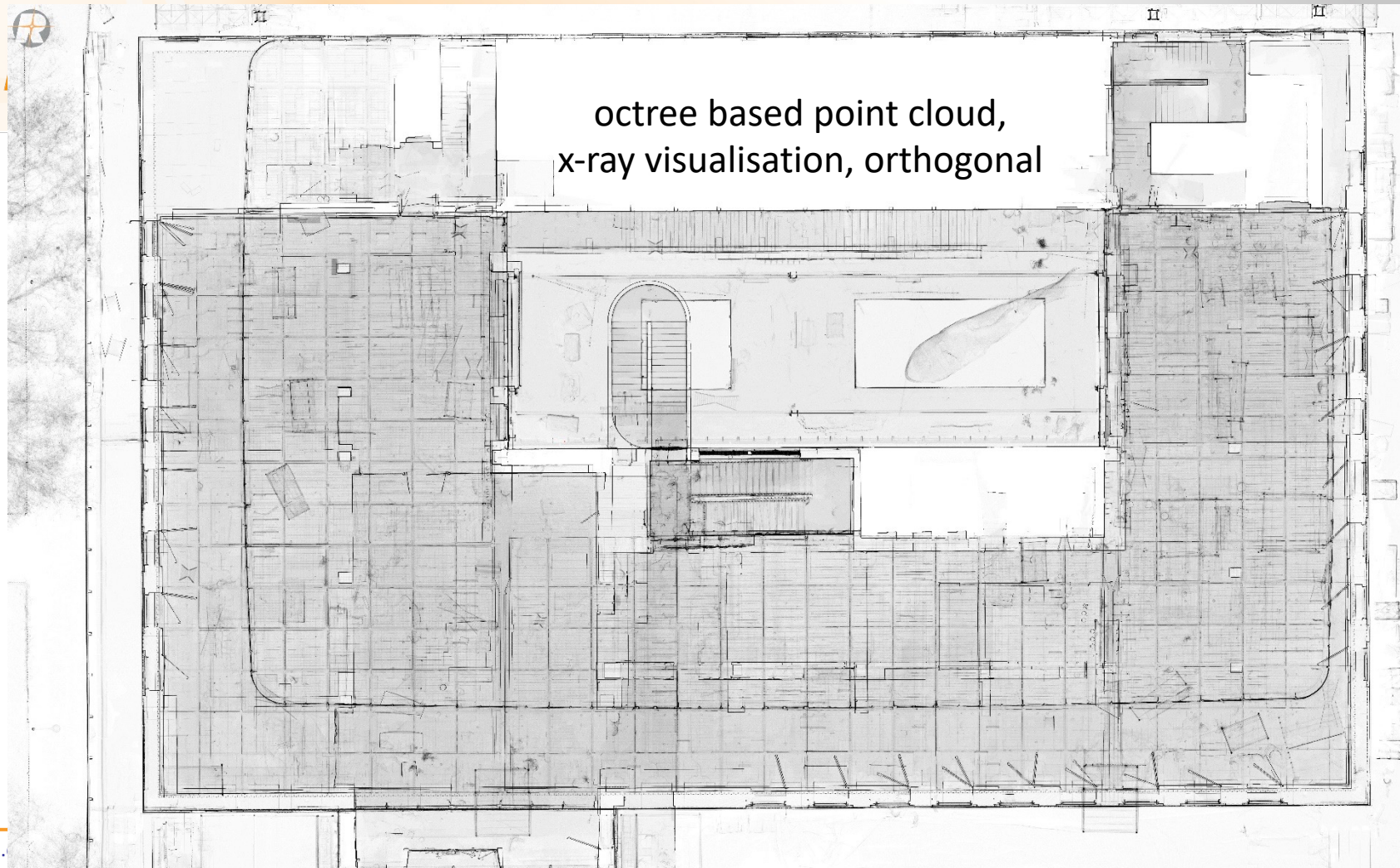


Vienna museum

scan time



scan & processing	one operator
data	20. Feb. 2023
scan acquisition	7:40 – 14:29
number of scan positions	438 (1min / scan position) with photographs
processing	multi-station adjustment (MSA), moving targets, 5mm octree based point cloud, colorization


octree based point cloud,
x-ray visualisation, orthogonal

GeoSysManager database file:

D:\RIEGL SCANS\2023_02_20_Wien_Museum_PORR\2023_02_20_Wien_Museum.RiS

Import

Source Coordinate Reference System: MGI / Austria Gauss-Kruger East / G

Datum Transformation: (none)

Scanner GNSS

Source Coordinate Reference System: (none)

Datum Transformation: (none)

RiSCAN PRO GLCS

Global Coordinate Reference System: MGI / Geocentric

Export

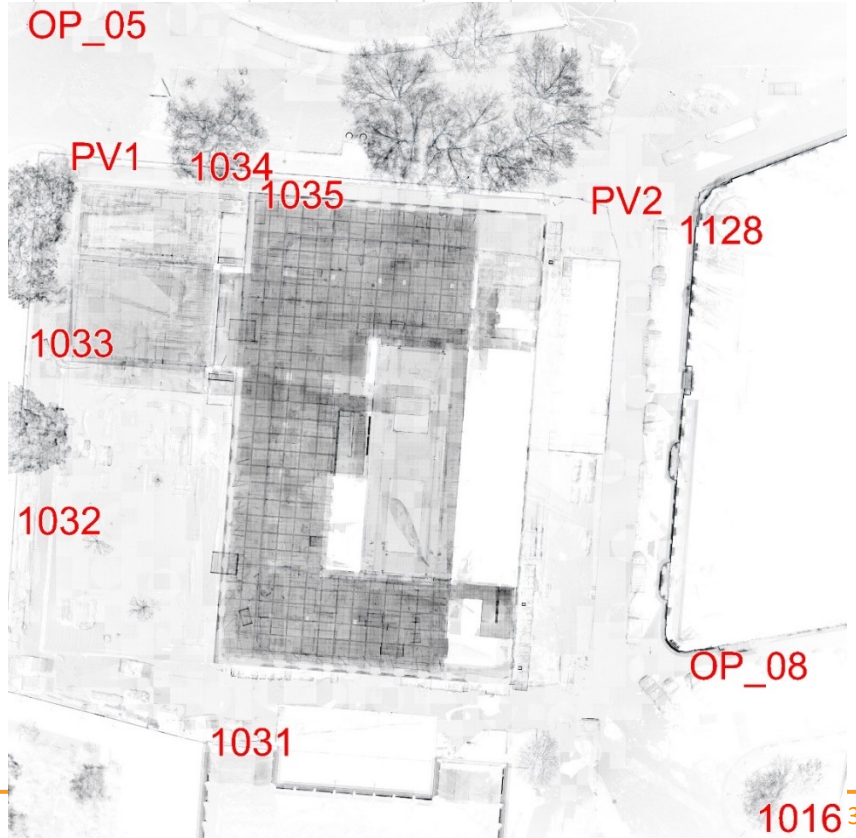
Datum Transformation: (none)

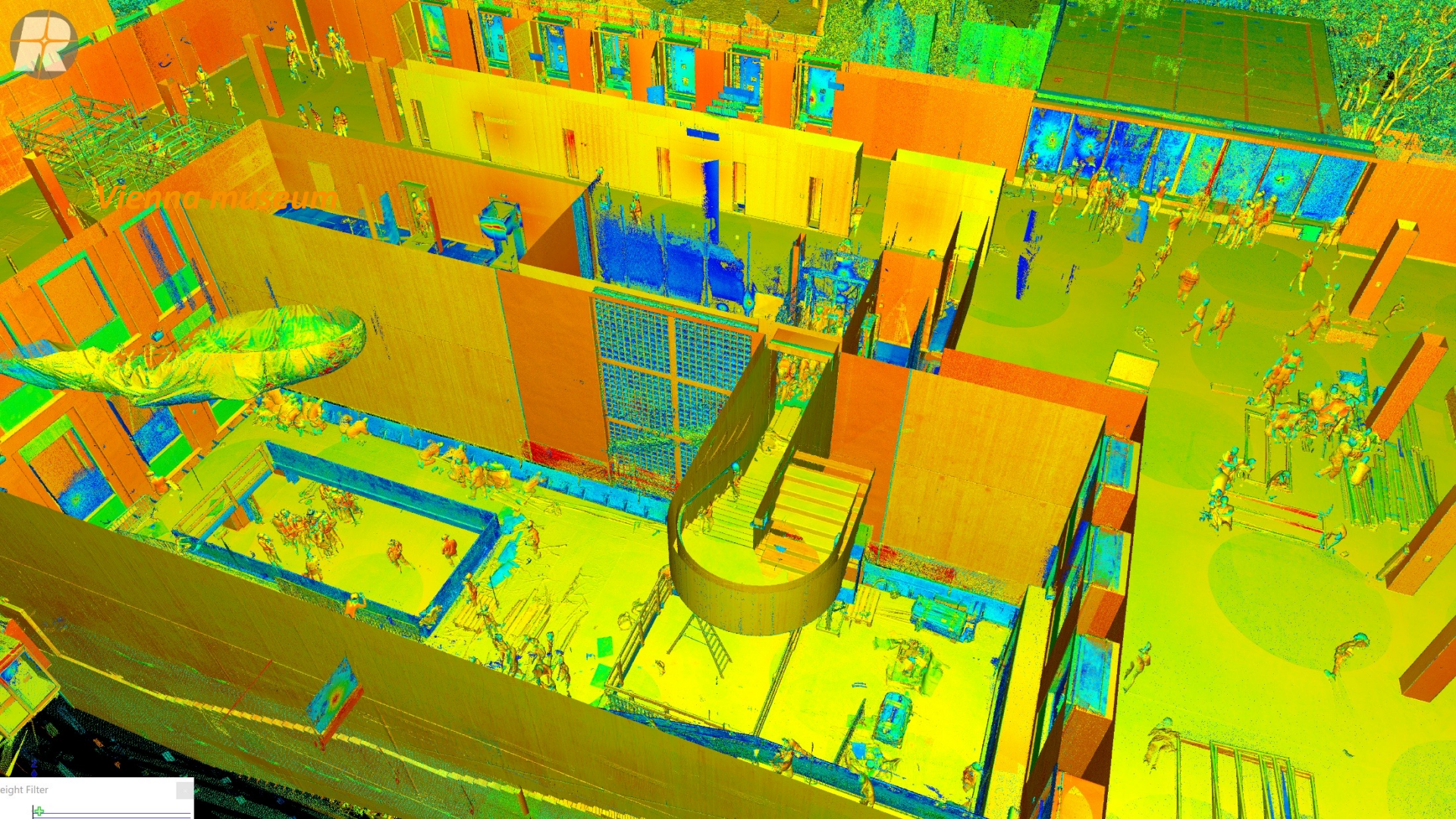
Target Coordinate Reference System: MGI / Austria Gauss-Kruger East / GEOID_BESSEL_Wien

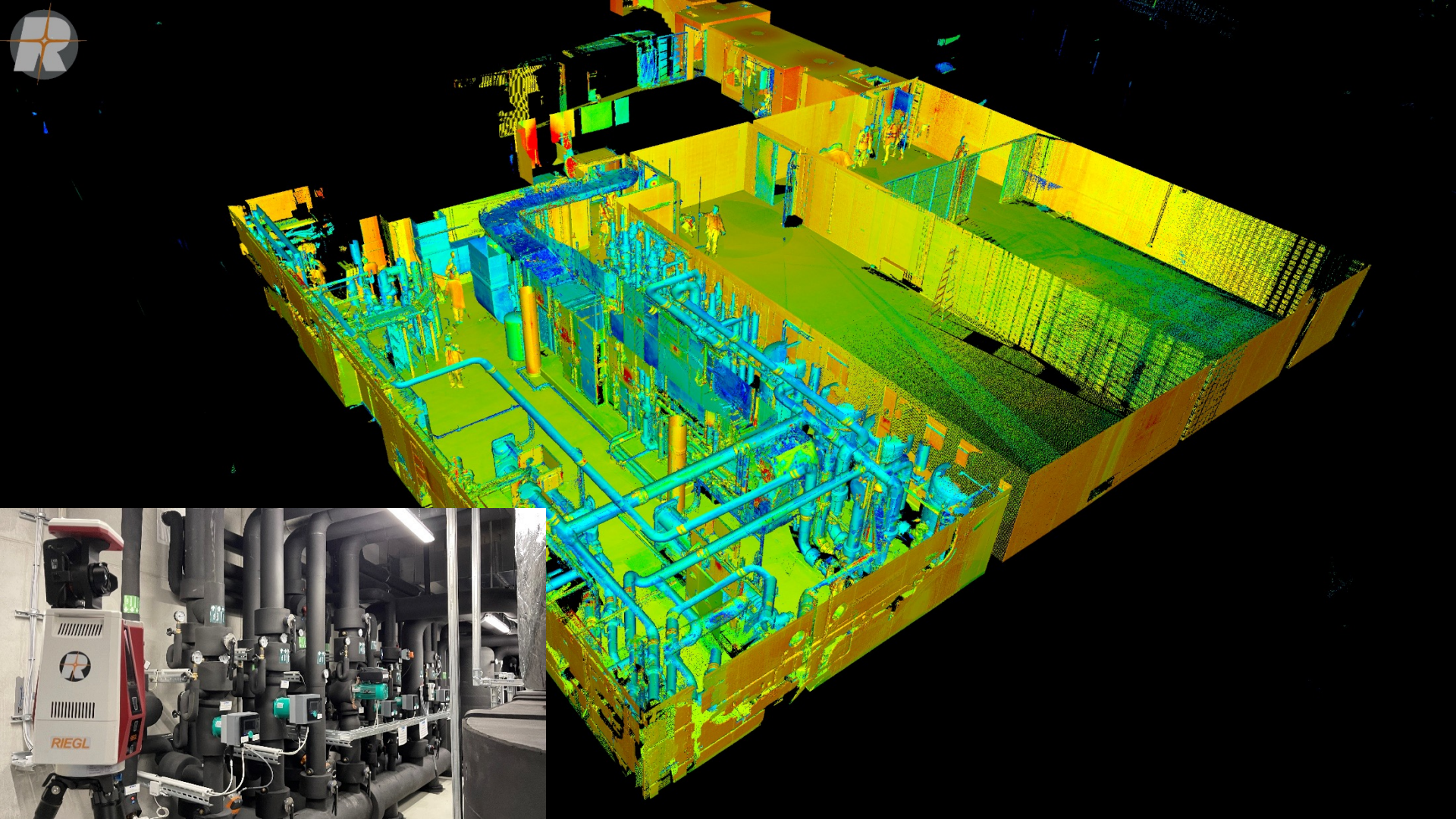
Name	Y	X	H
1031	3021.285	340051.730	2.172
PV1	3003.810	340125.367	0.131
PV2	3068.364	340119.896	0.062
1014	3078.678	340067.279	-0.402
1015	3081.725	340060.898	-0.765
1016	3089.321	340042.197	-0.519
1032	2997.002	340079.547	1.594
1033	2998.542	340101.889	1.307
1034	3018.617	340124.112	0.889
1035	3026.619	340120.578	-0.227
1128	3080.227	340116.145	-0.286

7 observations have been utilized on 7 control points in CRS. MSA results in the statistics on the residuals:

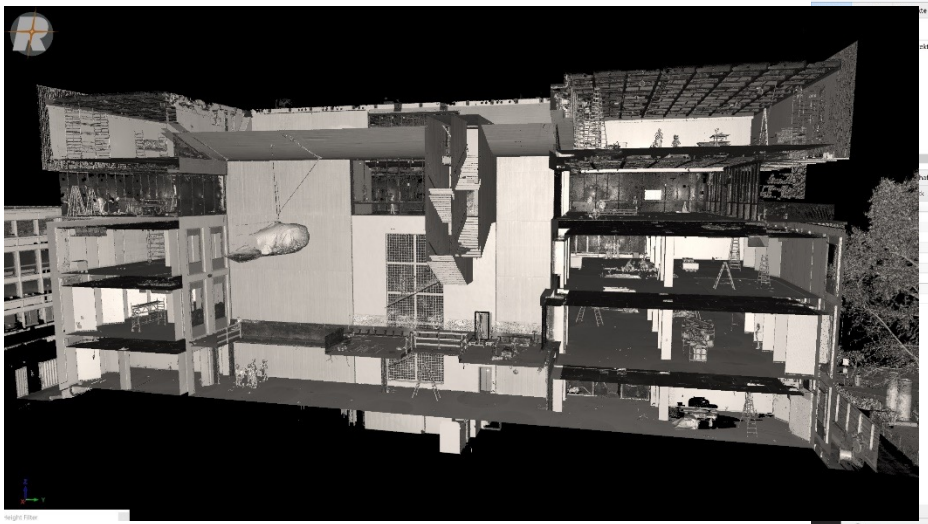
	dX [m]	dY [m]	dZ [m]	dist. [m]
Minimum deviation	-0.0091	-0.0052	-0.0150	0.0050
Maximum deviation	0.0115	0.0073	0.0175	0.0202
Mean deviation	0.0011	-0.0003	0.0005	0.0119
Standard deviation	0.0066	0.0042	0.0101	---

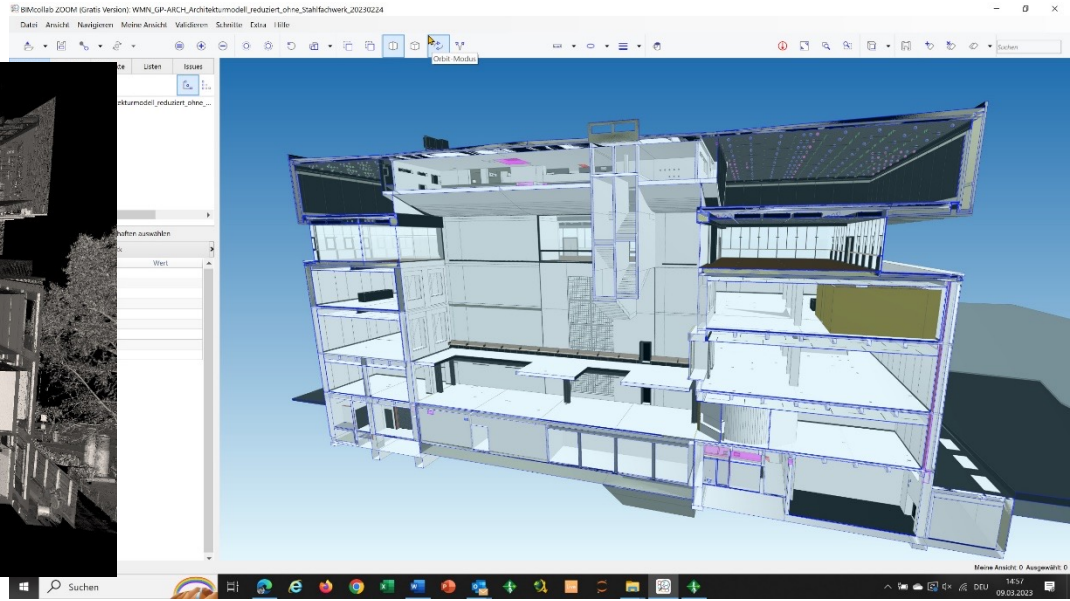



Vienna museum
eight Filter


RIEGL

comparison: point cloud / BIM model



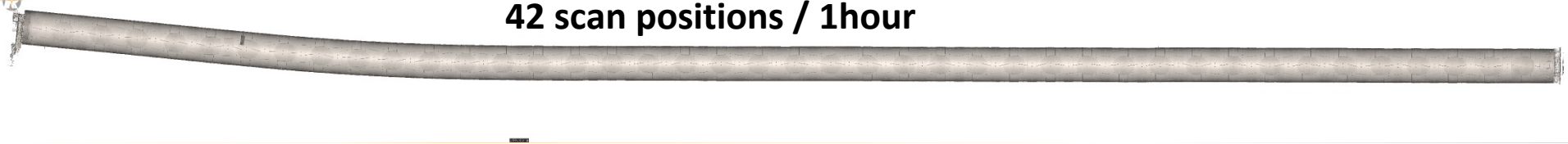


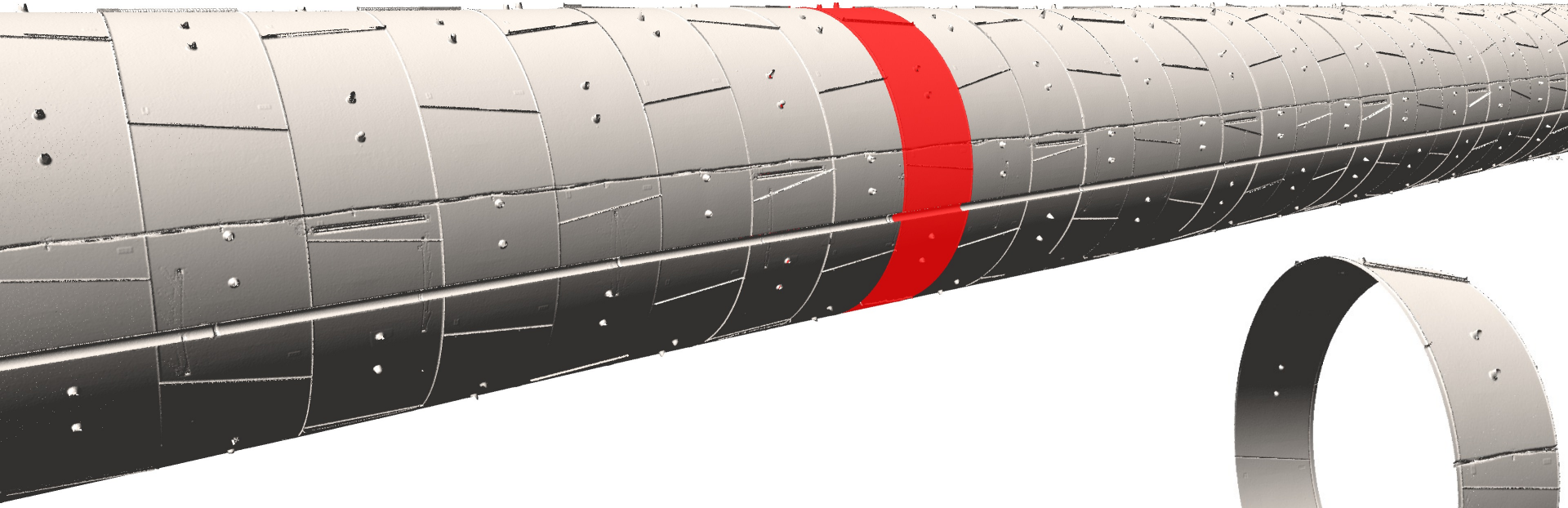
point cloud

BIM model

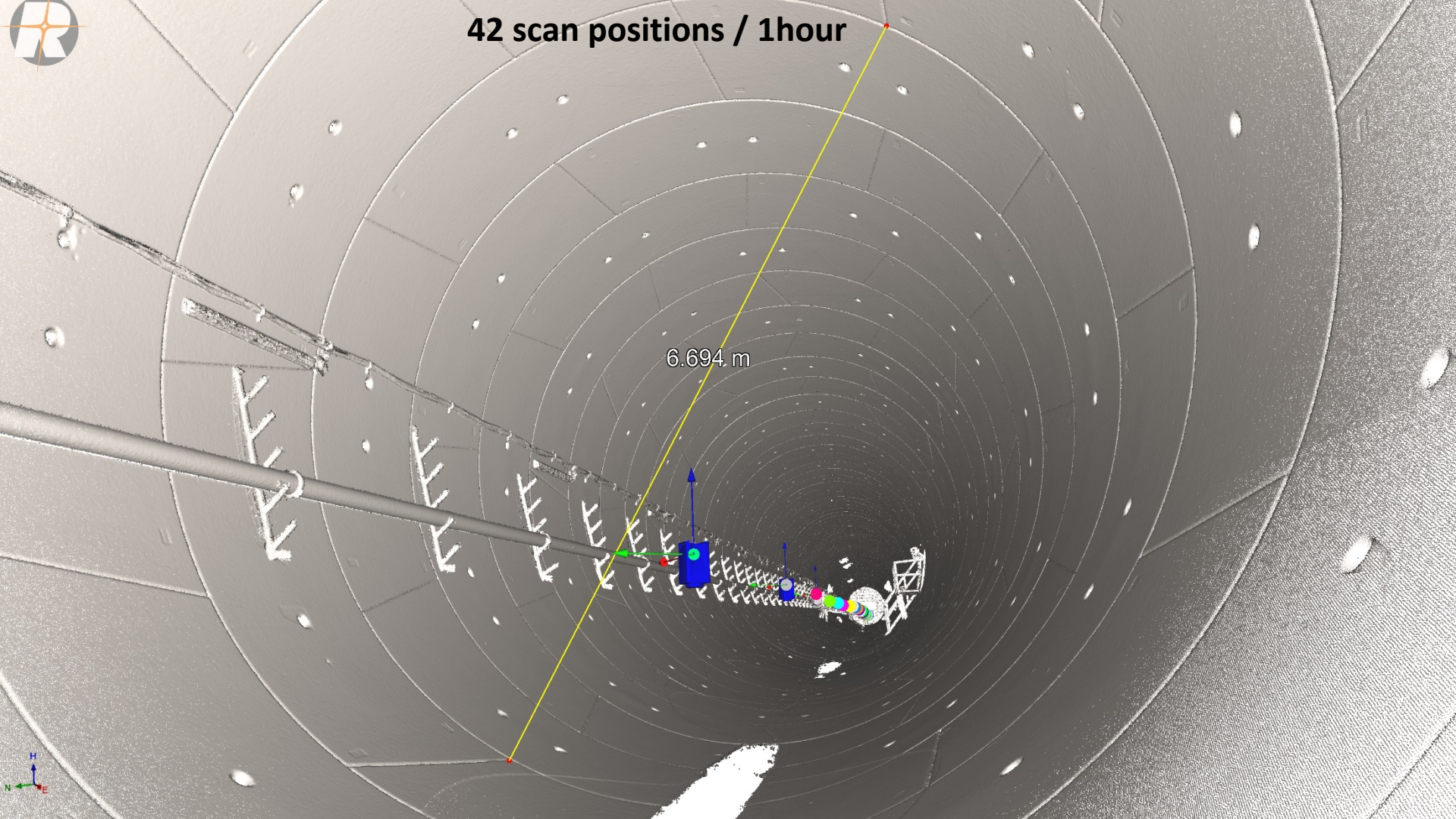
laser scan of a subway tunnel

42 scan positions / 1hour



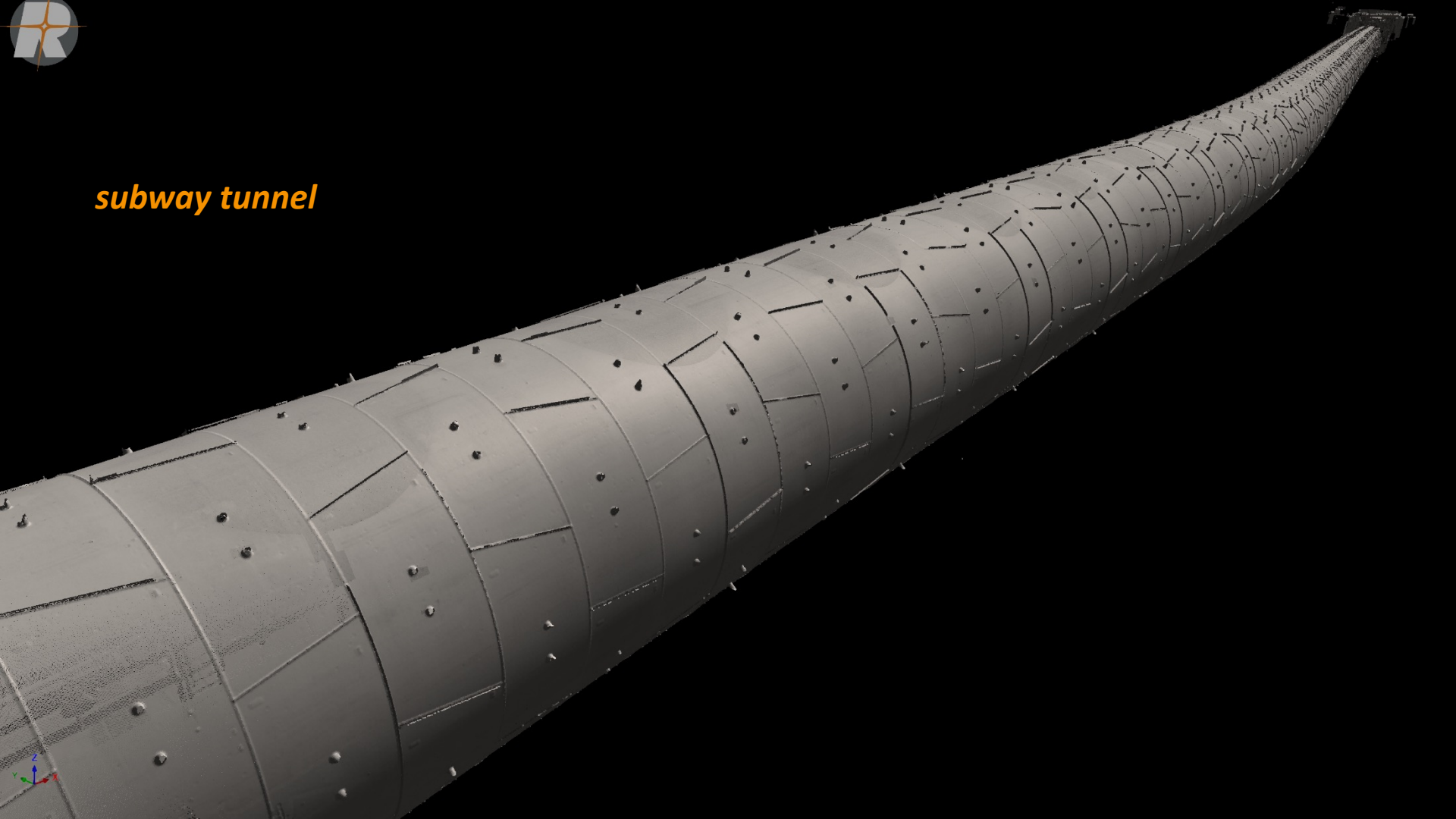


laser scan of a subway tunnel


42 scan positions / 1hour
6.694 m

control points

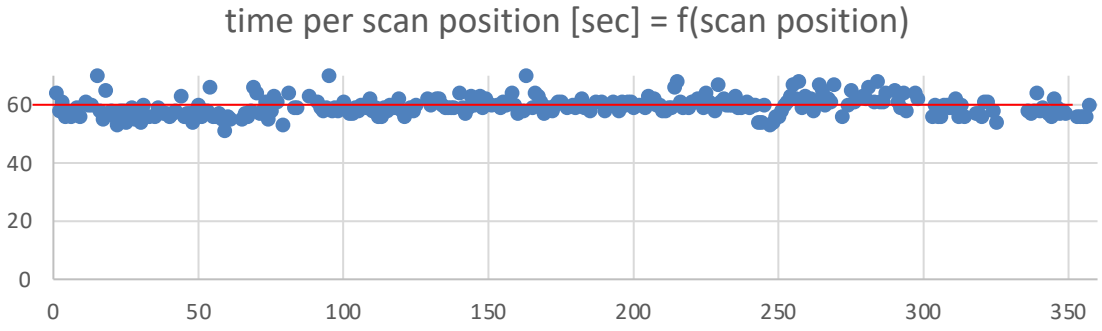
	dX [m]	dY [m]	dZ [m]	dist. [m]
Mean deviation	0.0001	0.0003	0.0001	0.0062
Standard deviation	0.0036	0.0031	0.0050	---
Median abs. dev. (std)	0.0050	0.0023	0.0042	---

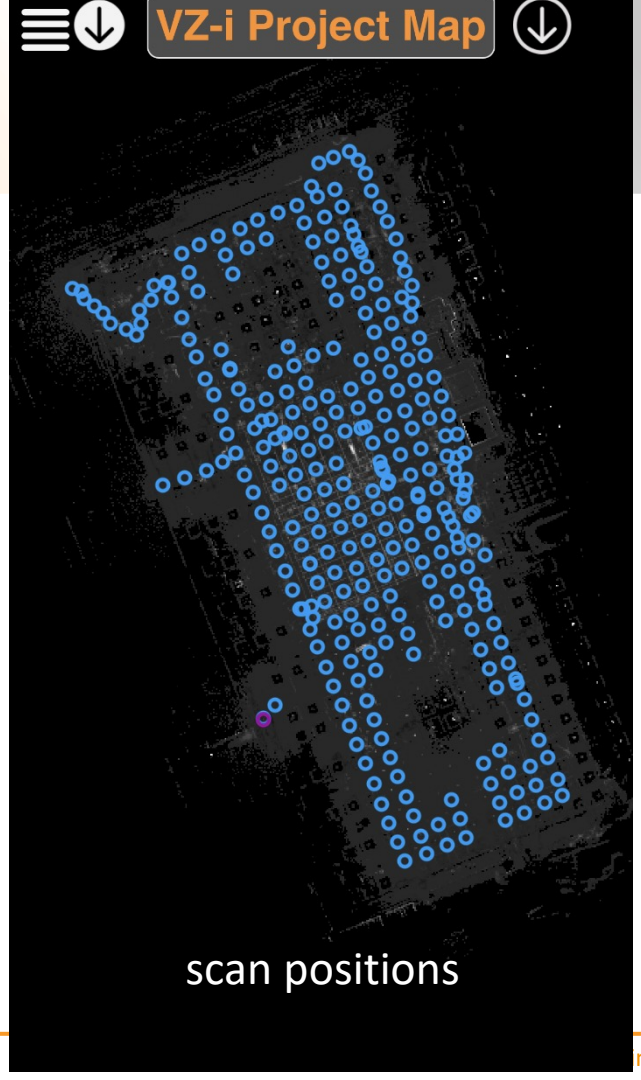

subway tunnel

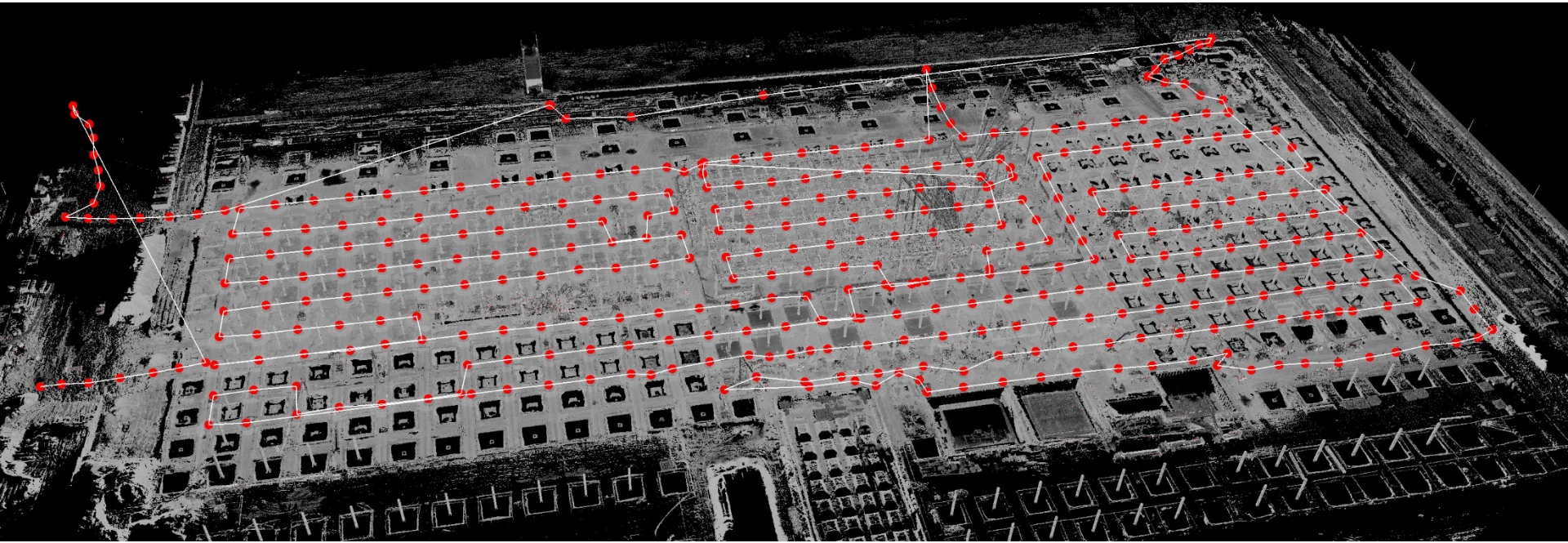
RIEGL®

Construction site Hungary

data acquisition	*RIEGL* VZ-600i laser scanner
date	19. April 2023
time	8:18 – 16:23
number of scan positions	379 (1 scan position / minute)





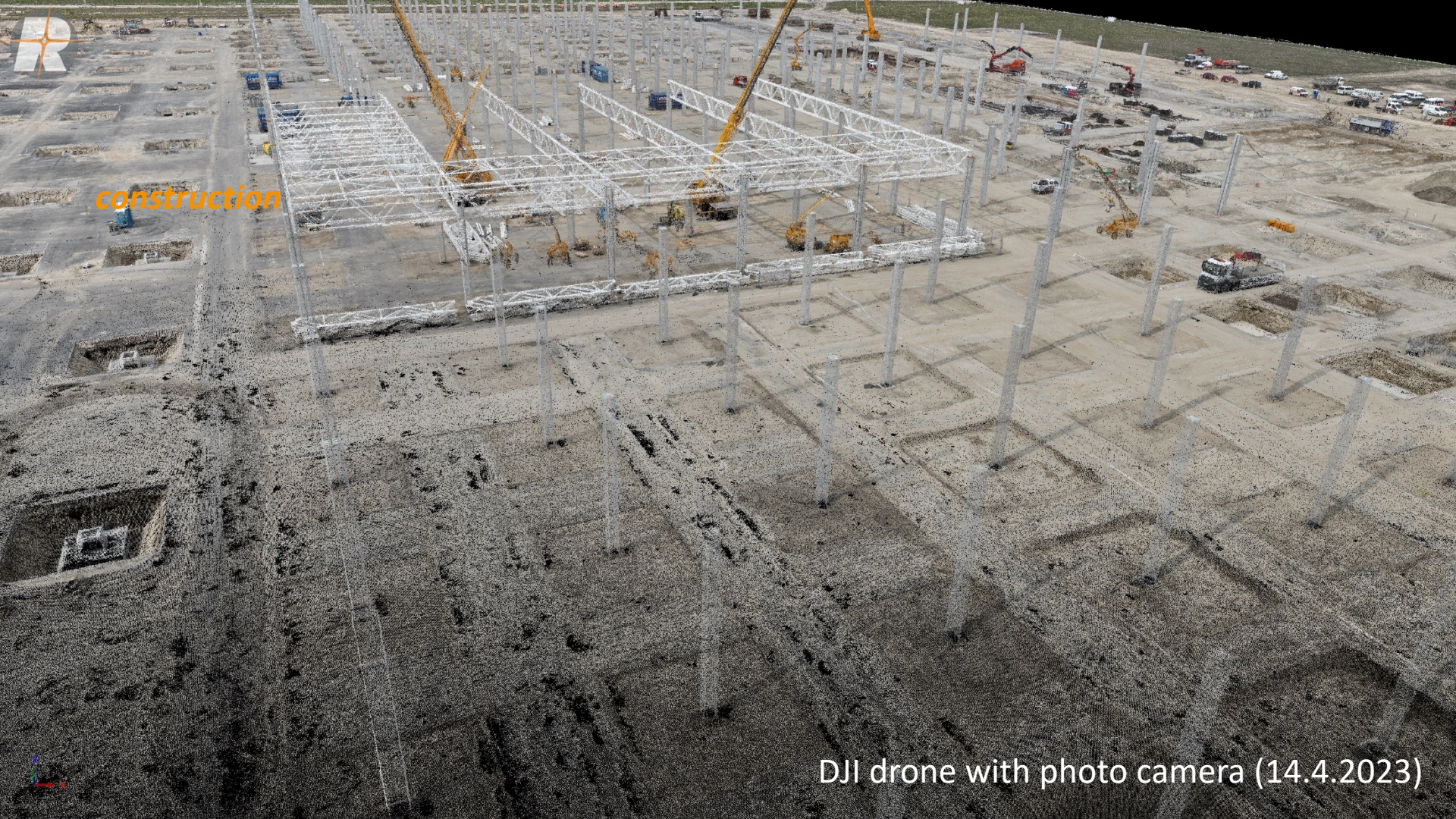


scan positions (6027 meter)

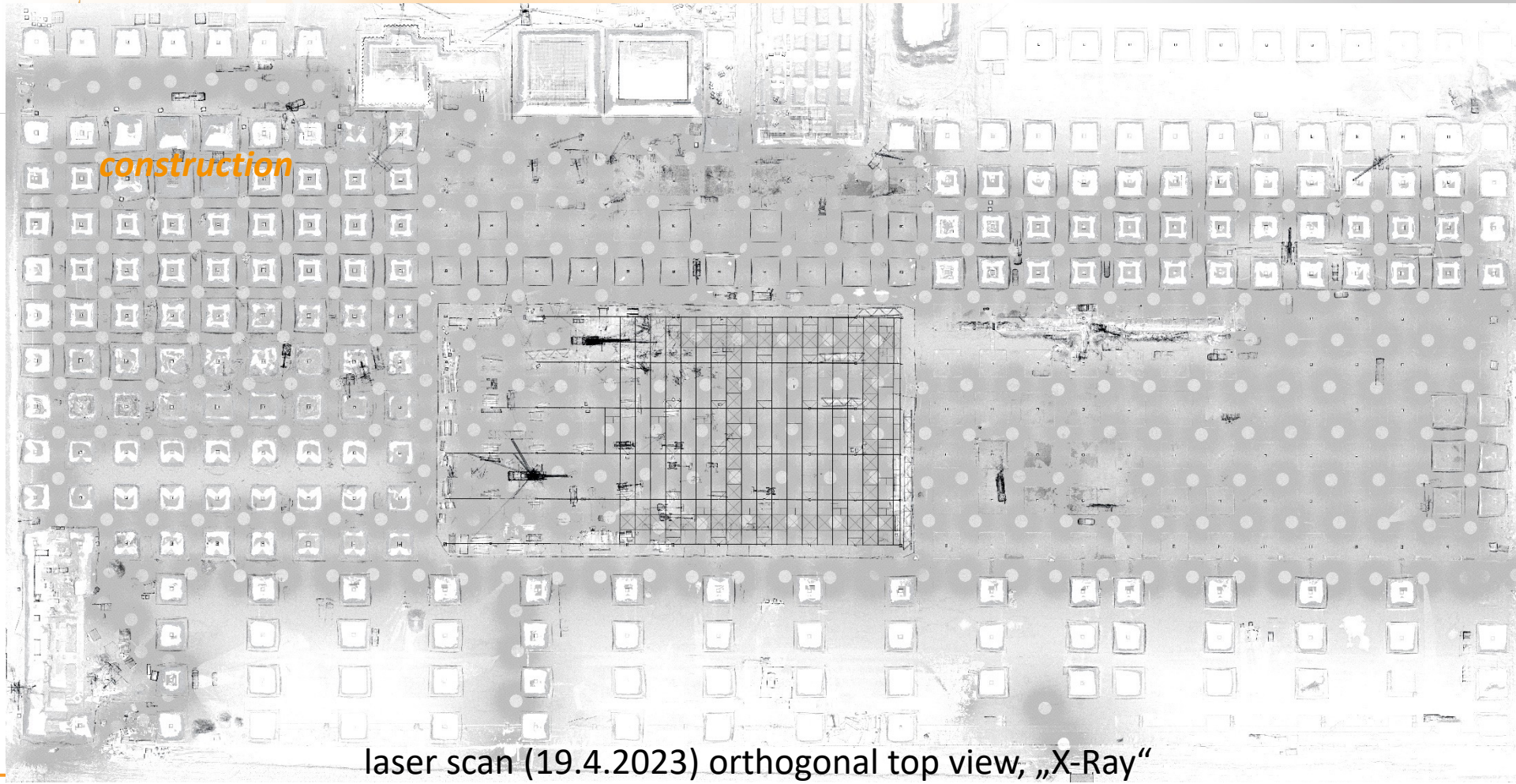

laser scan (19.4.2023)


DJI drone with photo camera (14.4.2023)

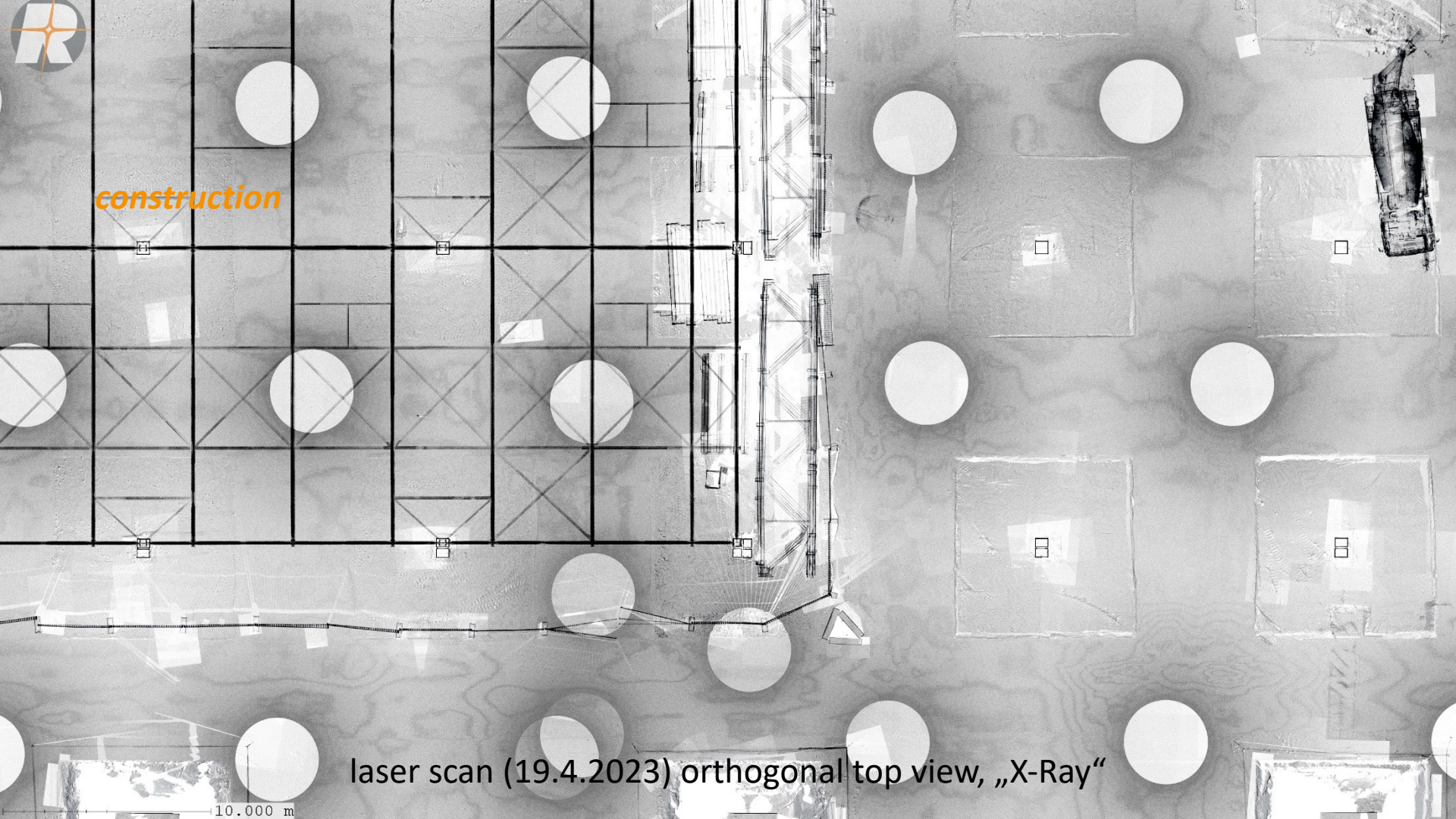

construction
laser scan (19.4.2023)



DJI drone with photo camera (14.4.2023)

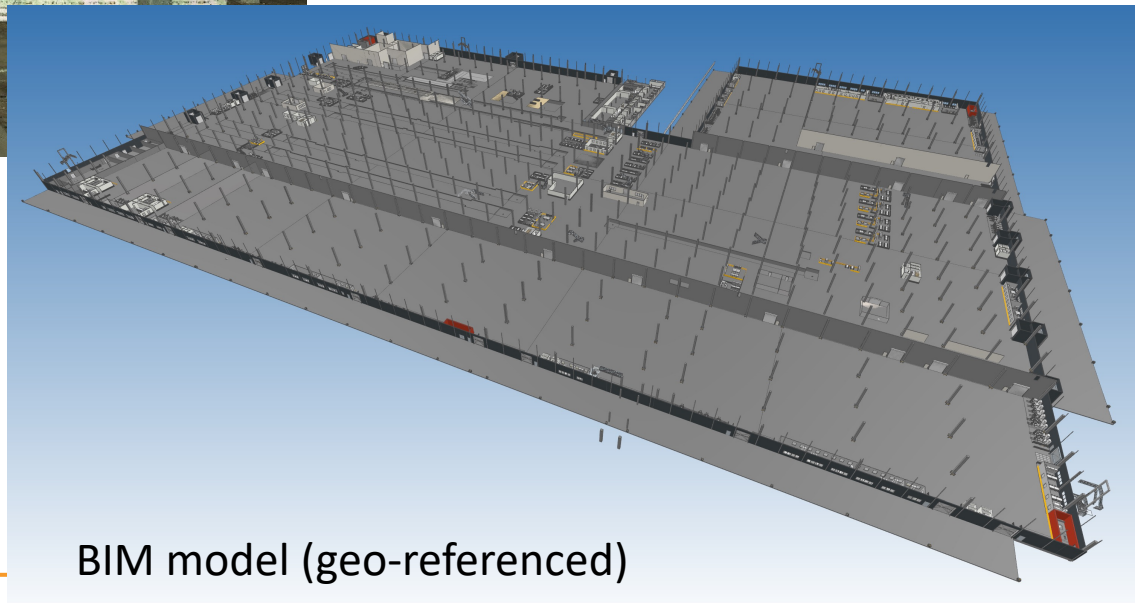


laser scan (19.4.2023) orthogonal top view, „X-Ray“



laser scan (19.4.2023) orthogonal top view, „X-Ray“

point cloud / 1cm resolution



BIM model (geo-referenced)

Thank you for your kind attention!

Nikolaus Studnicka
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nstudnicka@riegl.com