



Geosmart Asia 2018

*Automated Scan Data Registration
for Improving TLS Data
Acquisition Efficiency*

Thomas Gaisecker

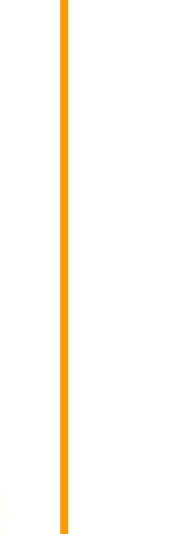
April, 2018



- RIEGL VZ-400i/VZ-2000i key facts
- Hardware/Firmware Architecture
- Onboard Realtime Postprocessing Tasks
- *Onboard Registration 2.0 – leaving the scene with a registered point-cloud*
- Example data from different applications

RIEGL VZ-scanner overview



									
VZ-400	VZ-400	VZ-1000	VZ-1000	VZ-1000	VZ-2000	VZ-4000	VZ-4000	VZ-6000	VZ-6000
max. range 600m	max. range 600m	max. range 600m	max. range 1400m	max. range 1400m	max. range 2050m	max. range 4000m	max. range 4000m	max. range 6000m	max. range 6000m
precision 3mm	precision 3mm	precision 3mm	precision 5mm	precision 5mm	precision 5mm	precision 10mm	precision 10mm	precision 10mm	precision 10mm
accuracy 5mm	accuracy 5mm	accuracy 5mm	accuracy 8mm	accuracy 8mm	accuracy 8mm	accuracy 15mm	accuracy 15mm	accuracy 15mm	accuracy 15mm
Laser Class 1	Laser Class 1	Laser Class 1	Laser Class 1	Laser Class 1	Laser Class 1	Laser Class 1	Laser Class 1	Laser Class 3B	Laser Class 3B

2008

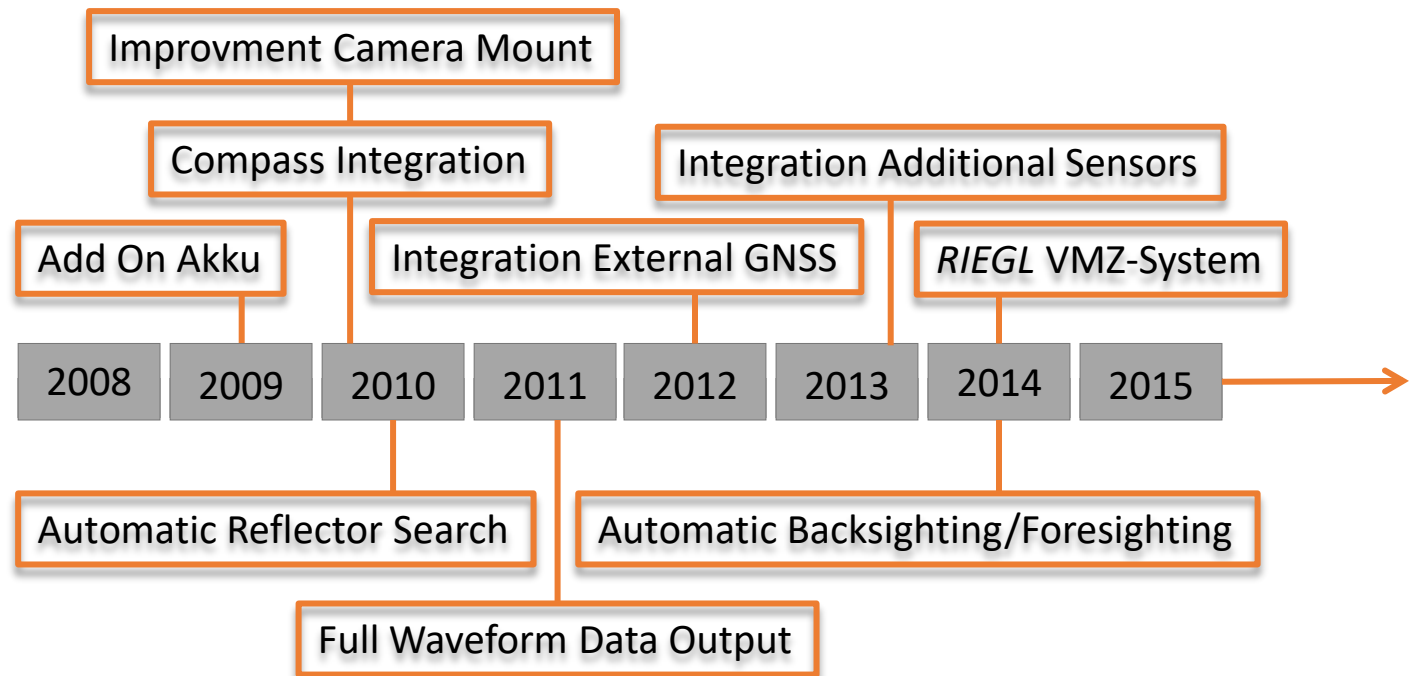
2010

2014

2011

2012

continuous developments on VZ-platform

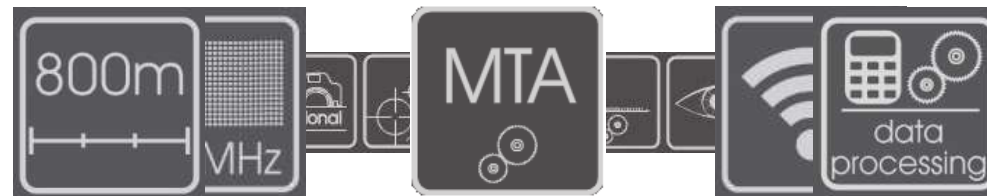


RIEGL VZ-400i / VZ-2000i key features



2015

- pulse repetition rate up to 1,2MHz
- effect. meas. rate up to 500.000/sec.
- max. range 800m (VZ-400i), 2500m (VZ-2000i)
- multiple-time around capability
- line speed – 240 lines/sec.
frame speed – 150°/sec.
- cloud connectivity
- **executing post-processing tasks**



2017

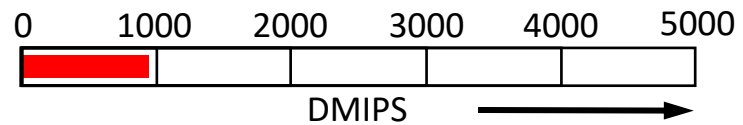
additional processing power



RIEGL VZ-400 / VZ-1000 / VZ-2000

single-core processor
running at 470 MHz

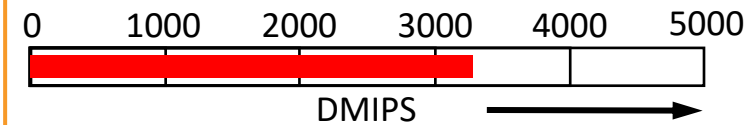
900 DMIPS



RIEGL VZ-400i / VZ-2000i

dual-core processor
running at 660 MHz

3300 DMIPS



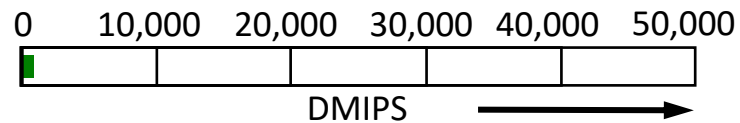
additional processing power



RIEGL VZ-400 / VZ-1000 / VZ-2000

single-core processor
running at 470 MHz

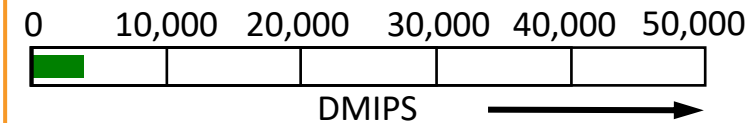
900 DMIPS



RIEGL VZ-400i / VZ-2000i

dual-core processor
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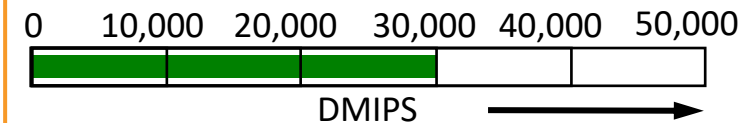
3,300 DMIPS



RIEGL VZ-400i / VZ-2000i LIDAR system

quad-core processor
@ up to 2.2 GHz

30,000 DMIPS



GPU with 192 cores
running at up to 850 MHz

VZ-400i / VZ-2000i LIDAR engine firmware

computational resources

- dual-core @ 660 MHz
- high performance IP cores

main tasks

- echo digitization
- online waveform processing
- data attributes
- data stream compression
- housekeeping and control

VZ-400i / VZ-2000i LIDAR system software

computational resources

- quad-core @ 2200 MHz
- GPU 192 cores @ 850 MHz

main tasks

- LIDAR engine commanding
- graphical user interface
- acquisition & processing of
 - camera images
 - GNSS data
 - pose sensor data
- managing interface
- executing post-processing tasks

post-processor runs libraries and executables

- RDBLibrary
- as used by RiSCAN PRO
- Creates point cloud database
 - spatially sorted
 - data compression
 - level-of-detail (LOD)
 - supporting arbitrary attributes
- enables e.g. visualization of large point clouds on tablets or on remote clients via low-bandwidth connections

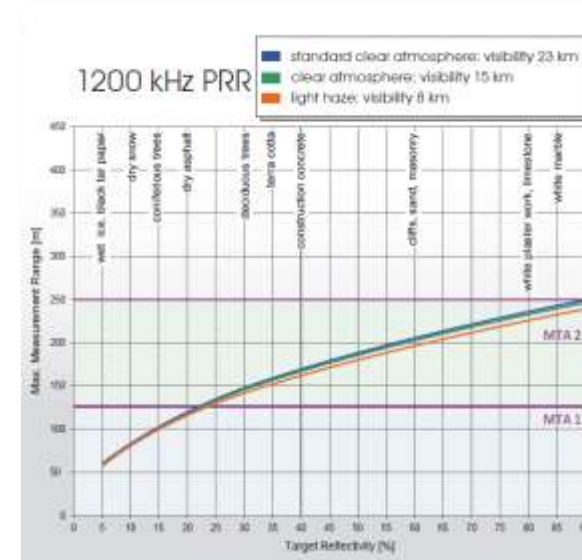
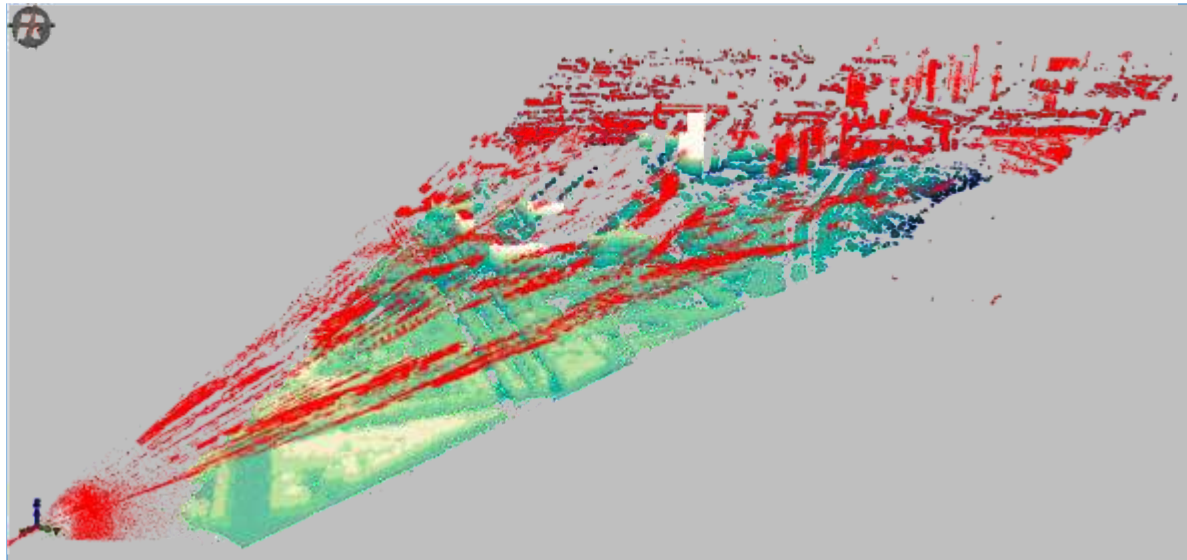


VZ-400i / VZ-2000i LIDAR System software



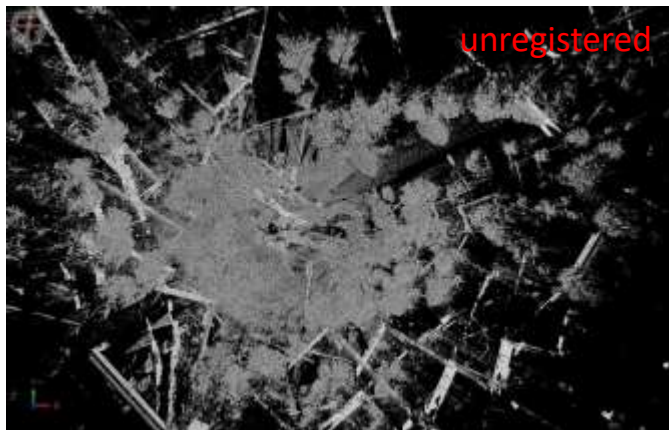
post-processor runs libraries and executables

- RDBLibrary
- RiMTA-TLS
 - solving range ambiguities caused by high pulse repetition rate



post-processor runs libraries and executables

- RDBLibrary
- RiMTA-TLS
- Registration Module
 - by in-built sensors (GNSS, IMU, Compass)
 - by automatic registration module 2.0



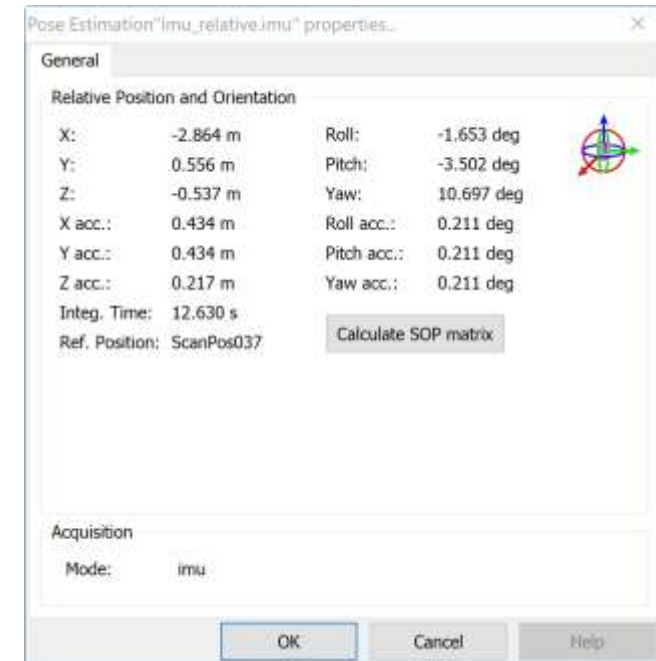
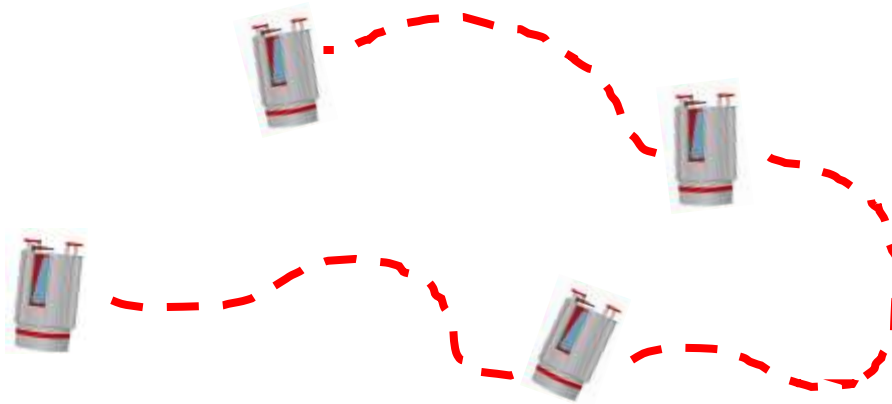
pre-registration by onboard sensors

outdoor

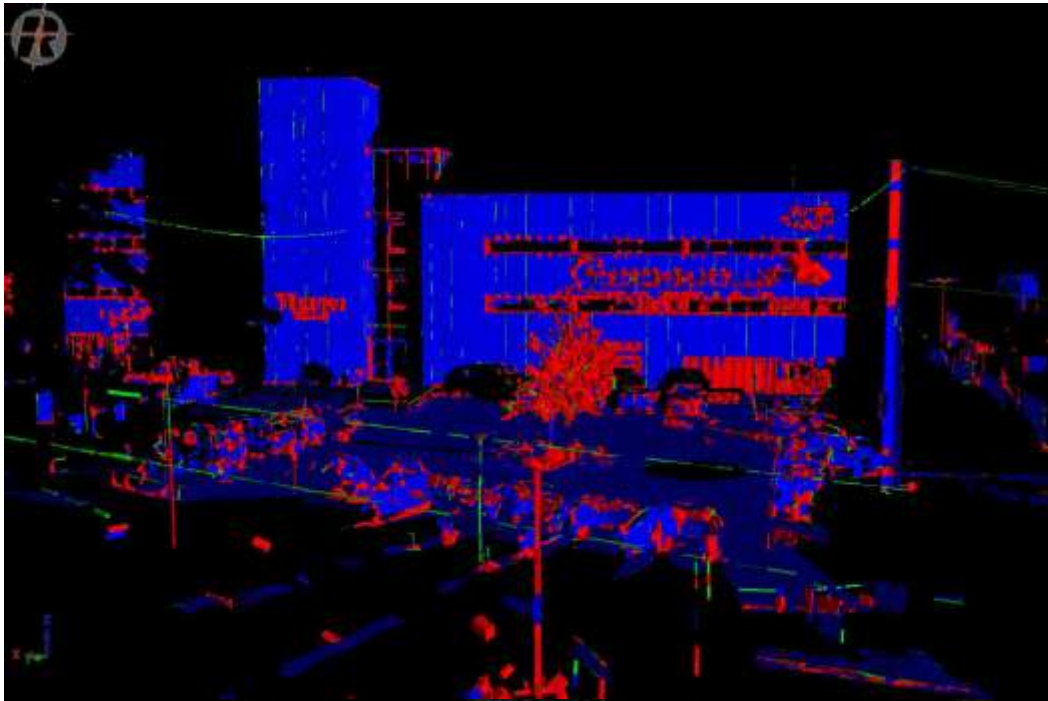
- GNSS data - position
- IMU data - roll/pitch
- magnetic compass - yaw

indoor

- first position user defined
- relative position and orientation by trajectory from IMU data

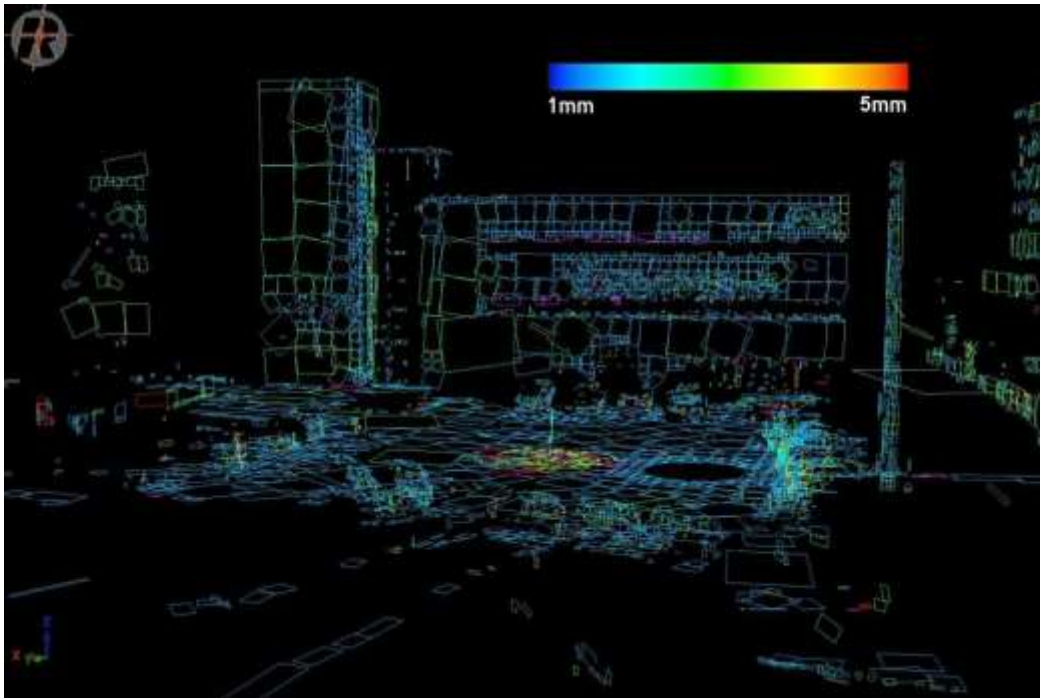


1st level registration by automatic voxel extraction and fitting



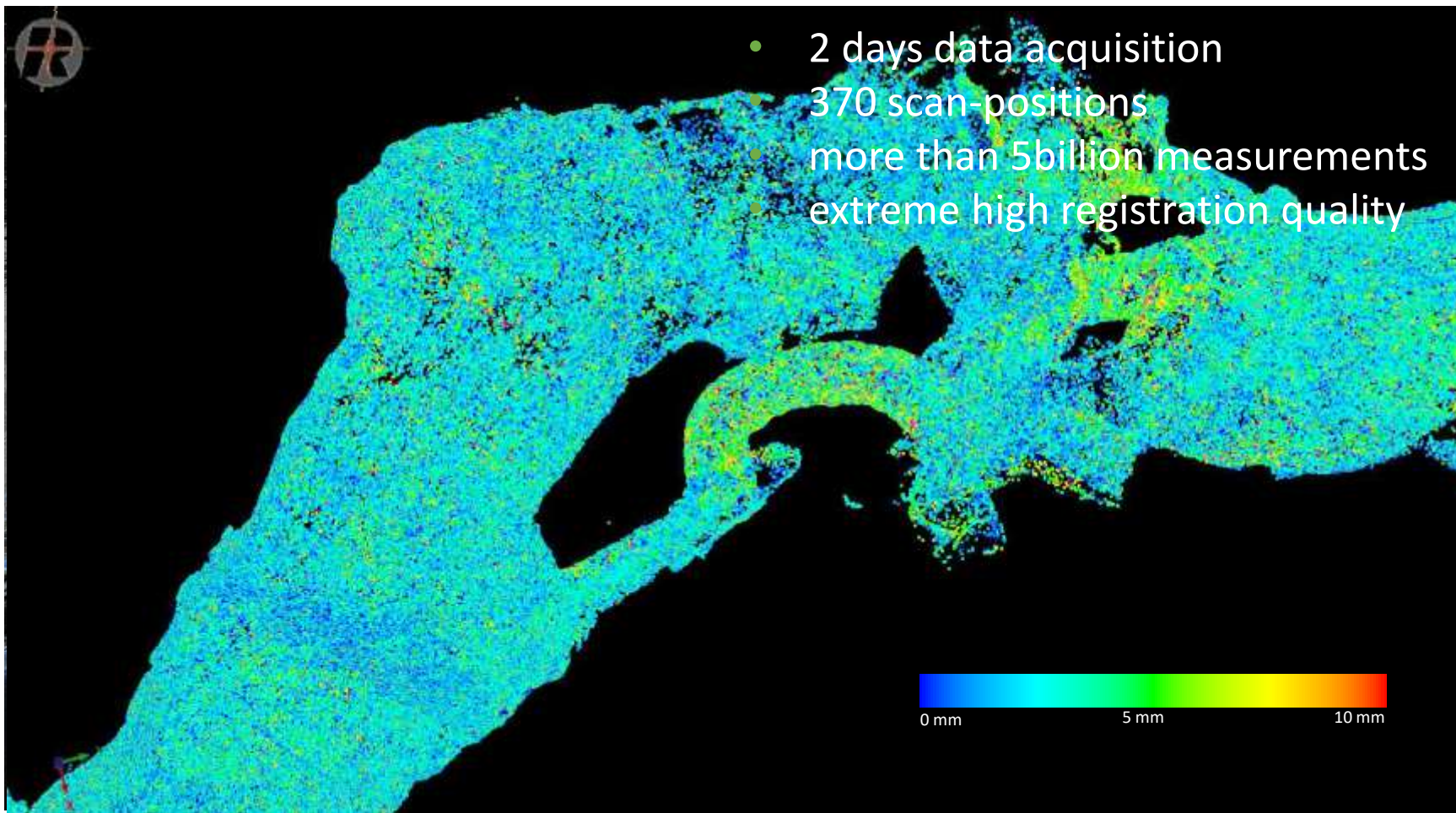
- scan-data
- voxels
- voxels with reflectance
- voxel classification
 - unregular
 - plane object
 - linear object
- voxel visualisation by class

2nd level registration by automatic plane extraction and fitting

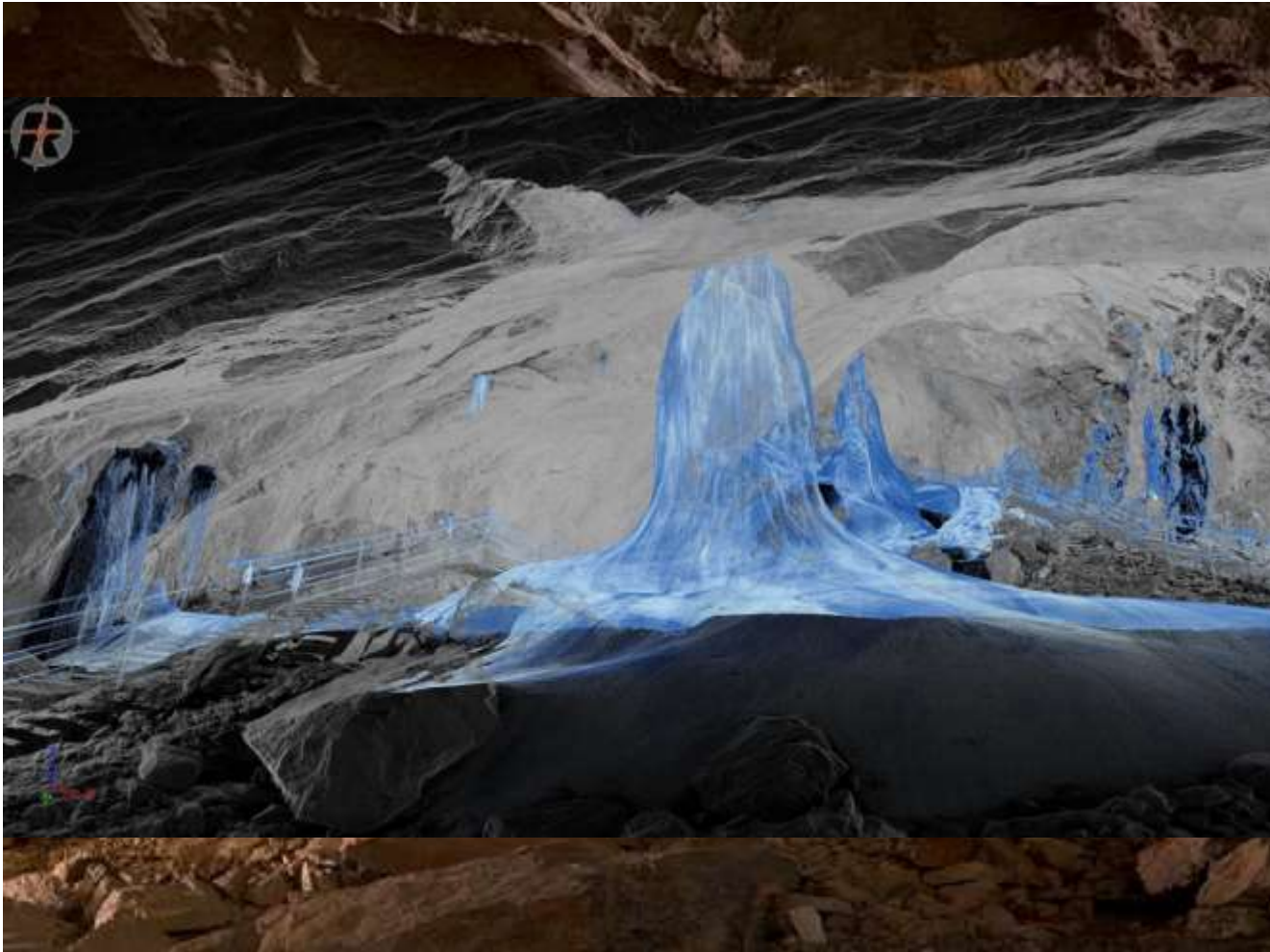


- scan-data
- planes – normal vectors
- planes - size
- planes – number of points
- planes – standard deviation

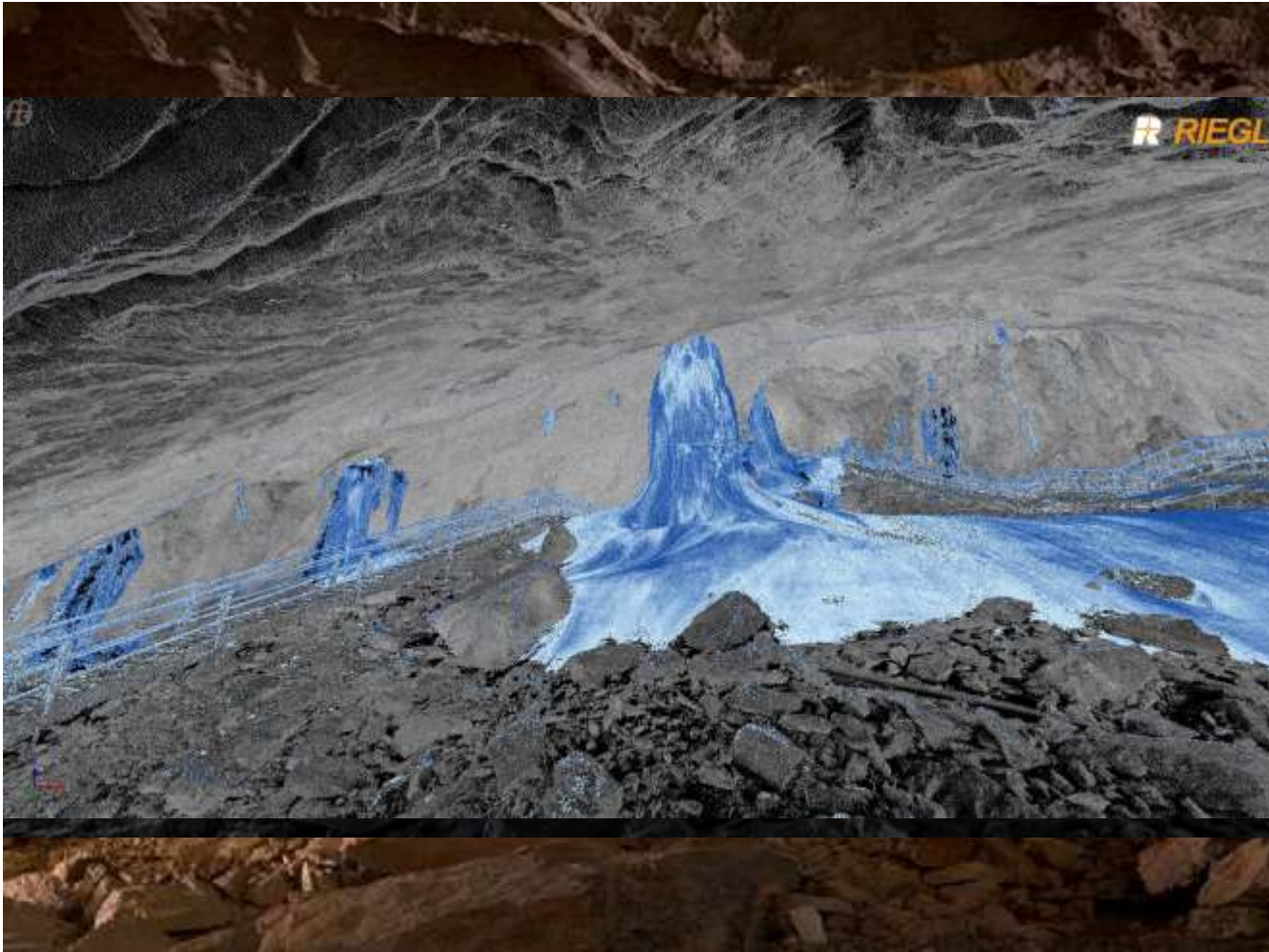
Automatic Onboard Registration Example Ice Cave



Automatic Onboard Registration Example Ice Cave

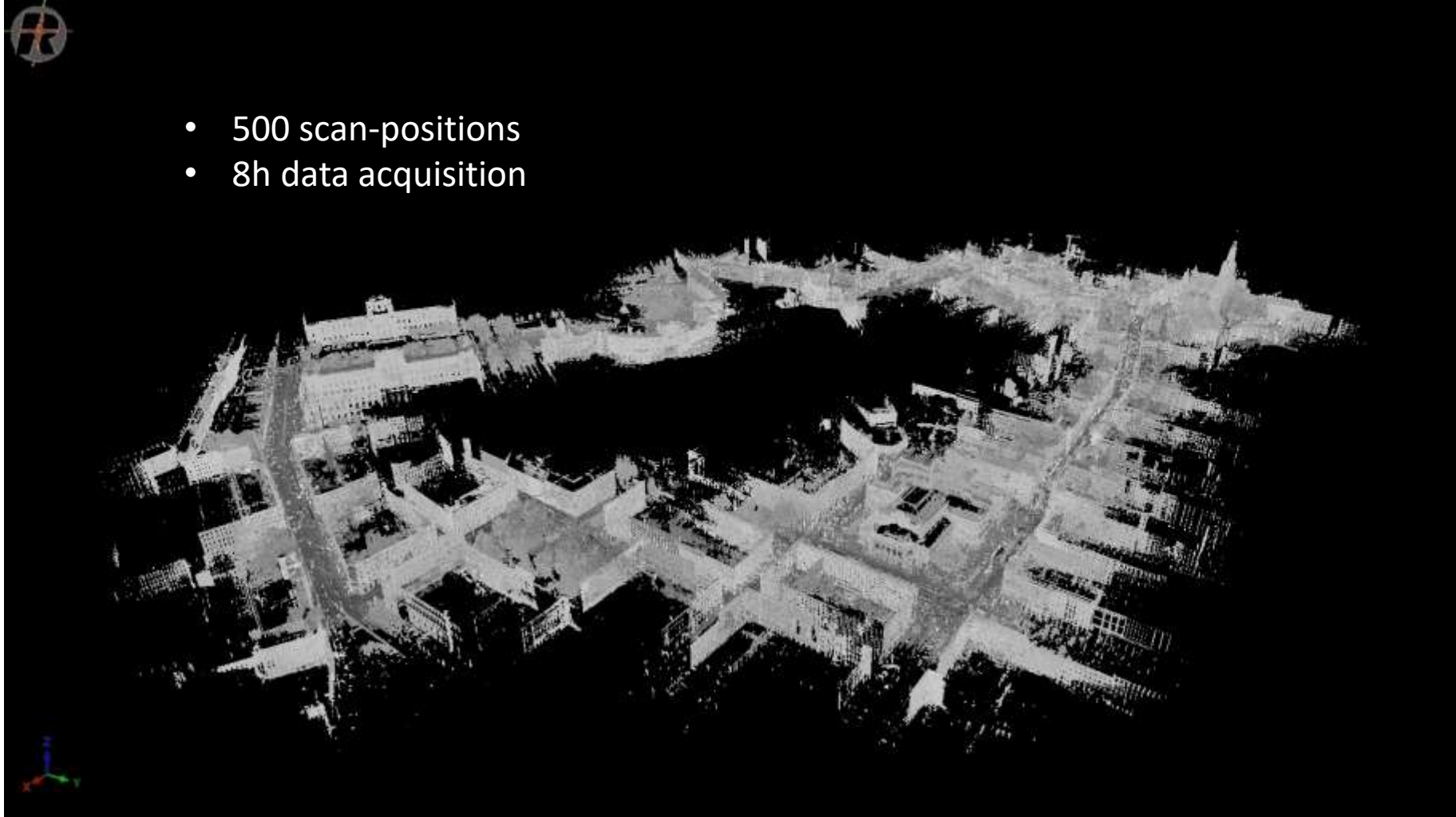


Automatic Onboard Registration Example Ice Cave



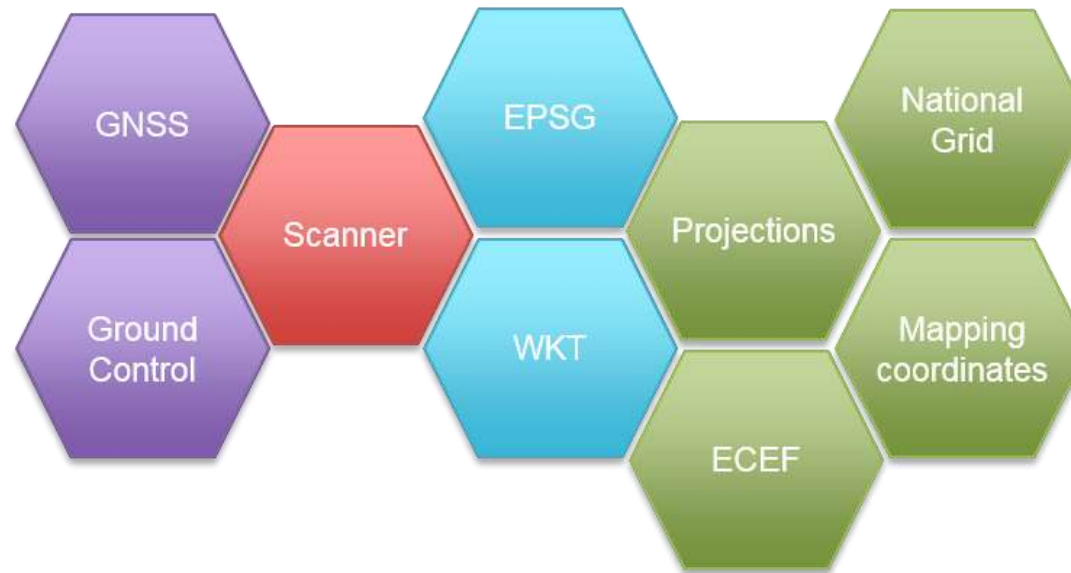
Automatic Onboard Registration Example City Scans

- 500 scan-positions
- 8h data acquisition



post-processor runs libraries and executables

- RDBLibrary
- RiMTA-TLS
- Registration Module
- GeoSysManager



- online EPSG database access
- fully customizable definitions
- Import/Export of any well-defined Coordinate Reference System

VZ-400i / VZ-2000i LIDAR System software



post-processor runs libraries and executables

- RDBLibrary
- RiMTA-TLS
- Registration Module
- GeoSysManager

GeoSysManager 2.0.8

Database Record Tools Settings Help

Database

- Database
 - Comments
 - Fundamentals
 - Units of Measure
 - Prime Meridians
 - Ellipsoids
 - Datums
 - Geodetic
 - Datum Transformations
 - General
 - Geoid Models
 - Map Projections
 - Engineering
 - Coordinate Reference Systems

Name	Type	Code	Comments
ETRS89 / Geographic	Coordinate Reference System	4258	ETRS89 / Geographic
WGS 84 / UTM zone 33N	Coordinate Reference System	32633	WGS 84 / UTM zone 33N
WGS84 / Geocentric	Coordinate Reference System	4978	World Geodetic System 1984
WGS84 / Geographic	Coordinate Reference System	4979	World Geodetic System 1984

Number of records: 4

GNSS

Status: RTK float

3D Accuracy (m): 0.0191

Number of Satellites: 14

WGS84, geographic 3D

Latitude (deg): 64° 39' 38.424994"

Longitude (deg): 63° 39' 20.353298"

Altitude (m): 361.0826

WGS 84 / UTM zone 33N

Easting (m): 548.200.3858

Northing (m): 5.389.949.1814

Height (m): 361.0826

Extended

File Explorer

V:\192.168.4.170\unim

Home Share View

Network: 192.168.4.170

Name

- backgrounds
- calibration_mobile
- cameras
- docs
- gnss
- guiapps
- licenses
- log
- lost+found
- manuals
- hikori_XM_Files
- patterns
- powersupply
- projects
- screenshots
- settings
- workflows
- gim.gifs
- loadoc_AUS.ini
- RIEGL_Software_EULA.pdf
- rimta5.jar

21 items 1 item selected 10.0 KB



post-processor runs libraries and executables

- RDBLibrary
- RiMTA-TLS
- Registration Module
- GeoSysManager
- Customizing your Scanner with APPS
 - Files - File Browser for data transfer between int. harddrive, SD-card, and USB-stick
 - Uploads - Tool for uploading data into the cloud
 - RiMOTE – Tool for scanner remote control
 - Tasks – lists and shows progress of tasks running in the background
 - Registration – Tool for onboard automatic registration
 - Scheduler – Tool for planning and scheduling scans
 - Timer – simple tool for acquiring scans every xx seconds
 - Screenshot – creates screenshots of the GUI every xx seconds



VZ-400i / VZ-2000i LIDAR System software



RDBLibrary	rawdata to 3d pointcloud processing
RiMTA-TLS	solving range ambiguities
Registration Module	combining scandata in one PRCS (P roject C oordinate S ystem)
GeoSysManager	transformation into any CRS (C oordinate R eference S ystem)
On Board Apps.	customizing the scanner according to your demands

