



Airborne Laser Scanning Technology and Data Acquisition

ChangeHabitat2 - International Workshop

on

Advanced remote sensing methodology development to support

Natura 2000 management actions across EU

Budapest

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Contents:

- Airborne laser scanners and systems
- Workflow of ALS survey and data processing
- Time-of-Flight range measurements and full-waveform analysis
- Multiple-Time-Around processing
- Geo-referencing ALS data
- Scan data adjustment
- Sample data







Airborne Laser Scanners and Systems



Airborne laser scanning is a rapid, highly accurate and efficient method of capturing 3D data of large areas.

for planes:

LMS-Q680i / LMS-Q560

- Multiple-Time-Around (MTA) Processing (LMS-Q680i)
- Full Waveform Analysis for an unlimited number of target echoes
- operating flight altitude up to 5,000 / 3,300 ft AGL
- Laser PRR 400 / 240 kHz

for helicopters:

NEW RIEGL VQ-580

- optimized for glacier and snow measurements
- RIEGL VQ-480 / VQ-380**
- echo digitization and Online Waveform Processing
 - multiple target capability
 - operating flight altitude up to 2,500 / 1,800 ft AGL



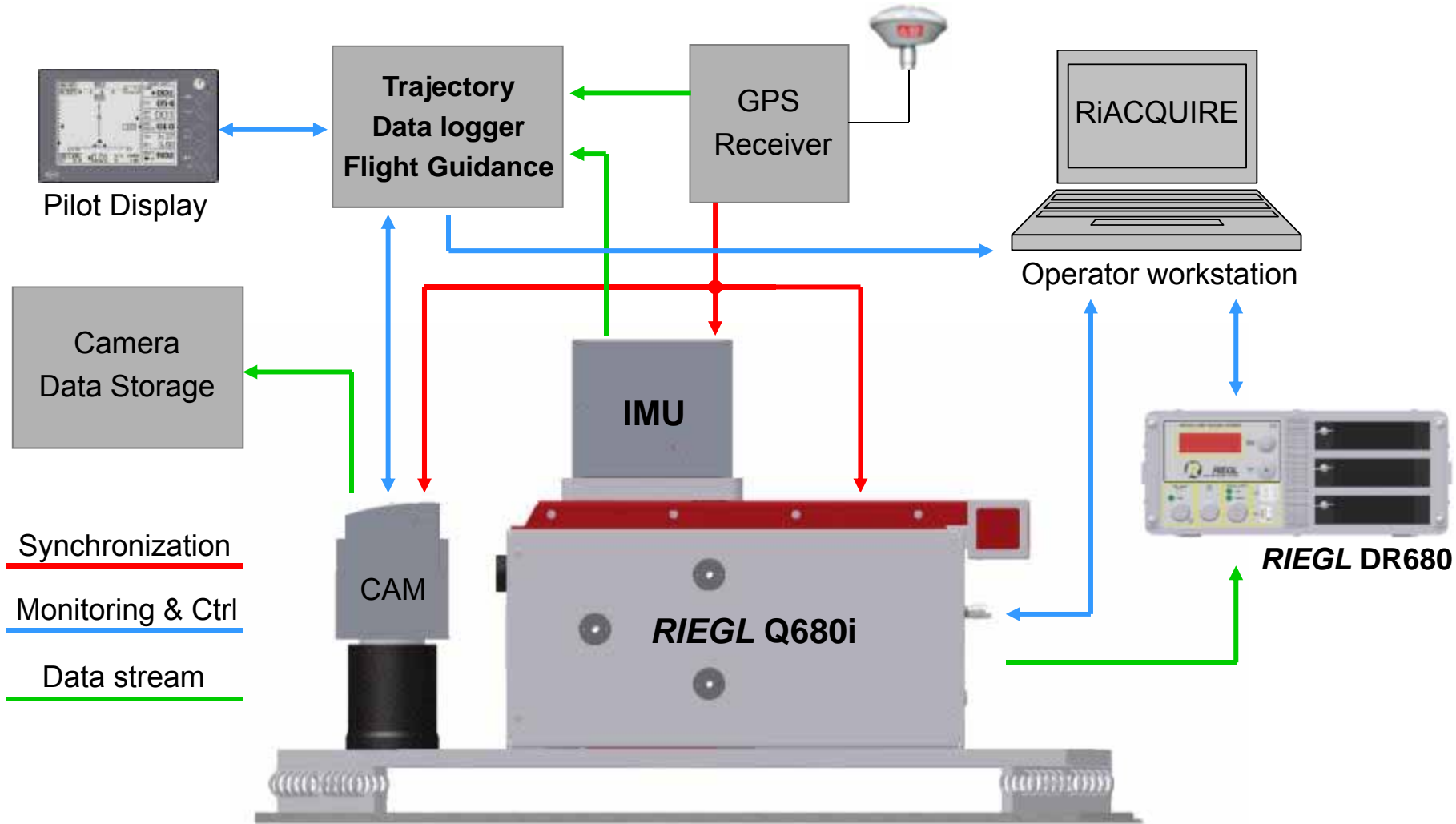
APPLANIX POS AV



IXSEA AIRINS



IGI AEROCControl & IGI CCNS



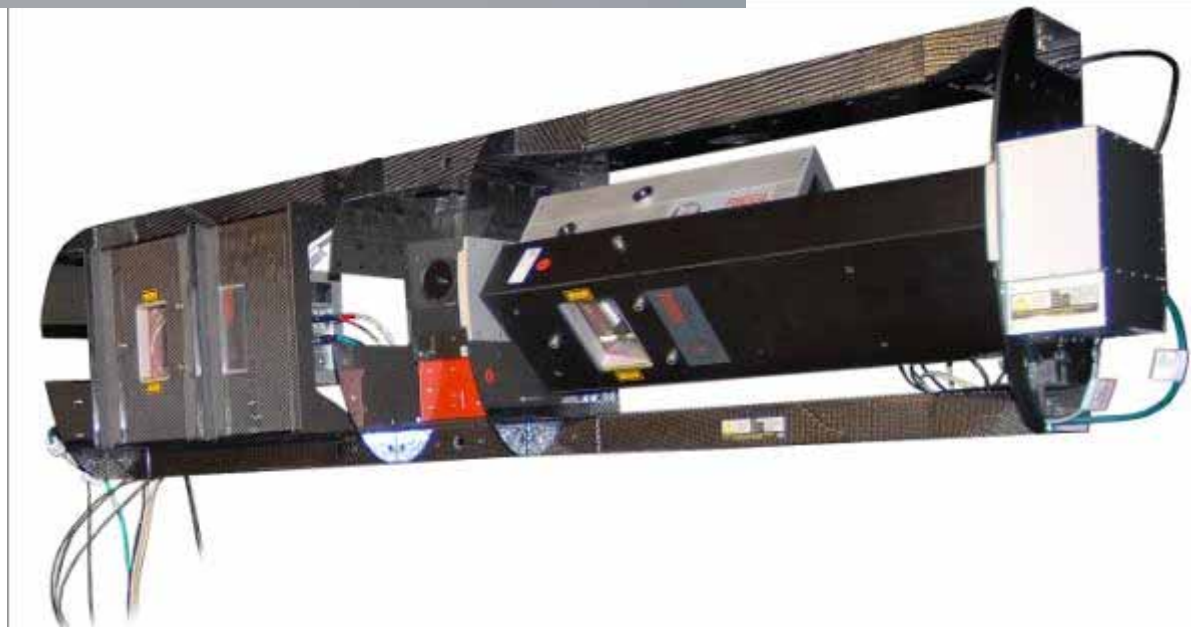
Block diagram ALS System

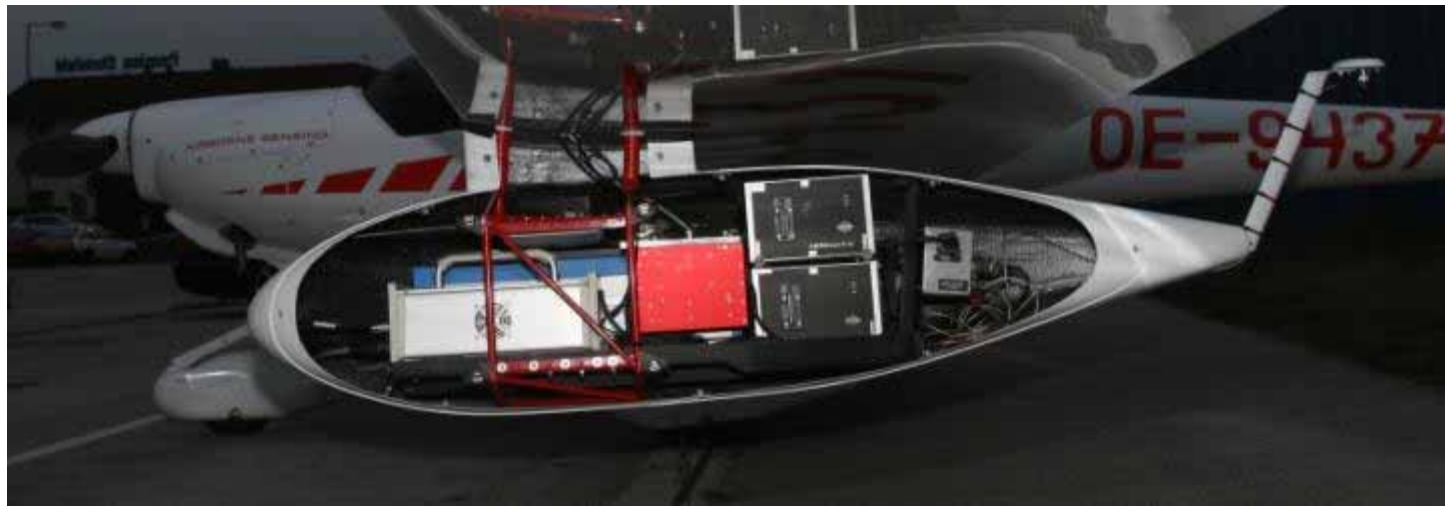


NEW RIEGL NP680i

Highly compact, flexible and efficient turnkey ALS solution, fully EASA certified, comprising LMS-Q680i, DR560-RD, ALS software, INS/GNSS unit, and FMS, smoothly integrated into the "Universal Nose" of the Diamond twin-engine plane DA42 MPP.







RIEGL LMS-Q560 – Diamond HK36





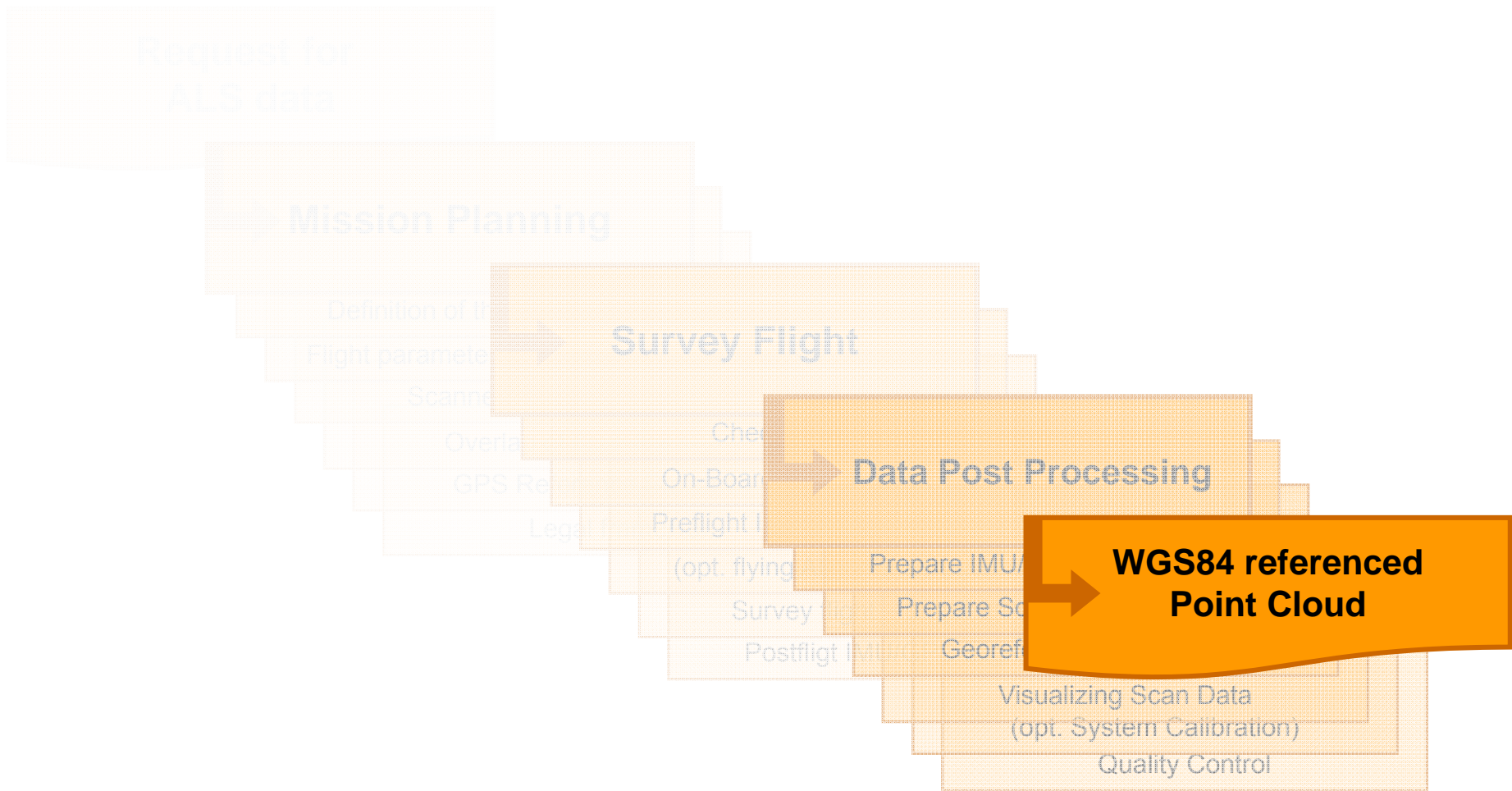
RIEGL CP680 – Vulcan Air P68



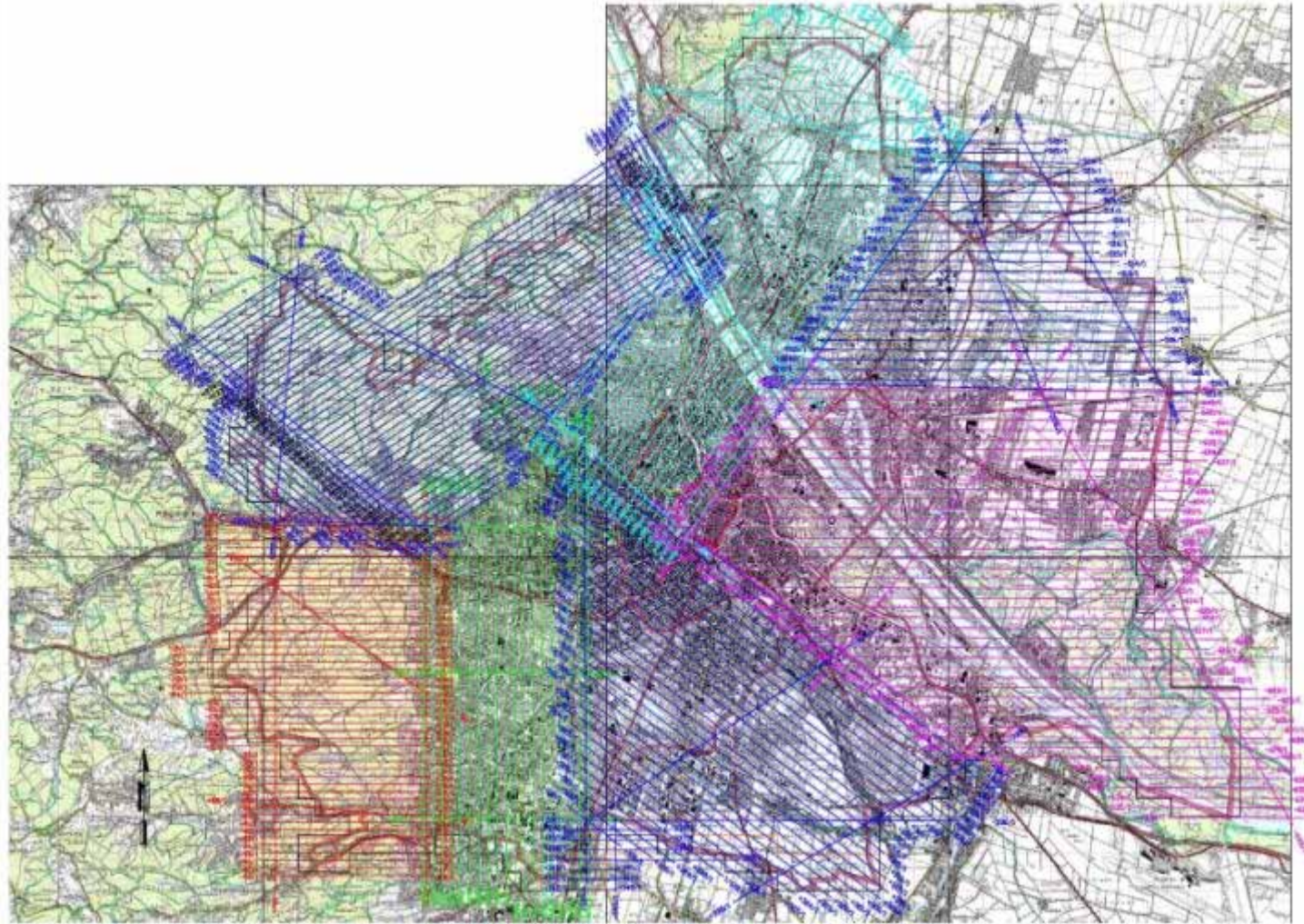
Custom Integration *RIEGL* Q560 – Bell Jet Ranger



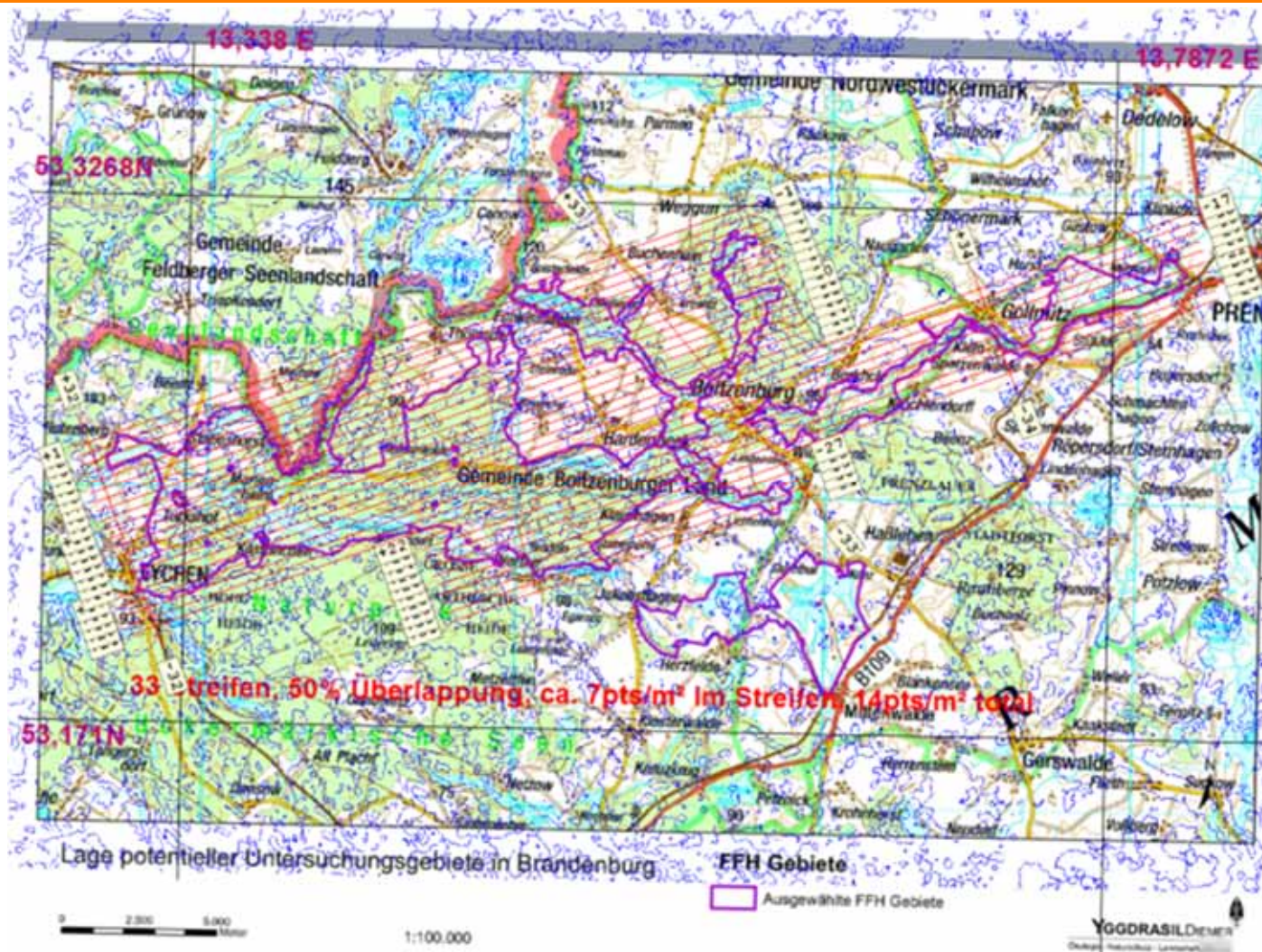
Workflow of ALS survey and data processing



ALS data processing workflow

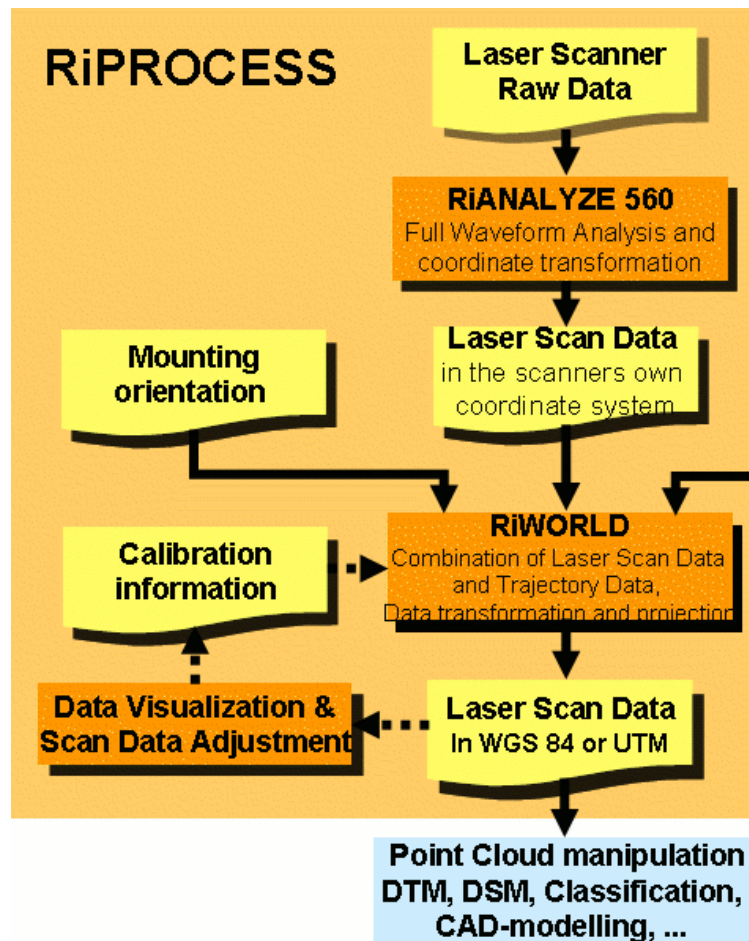


Typical Flight plan – Vienna 2006





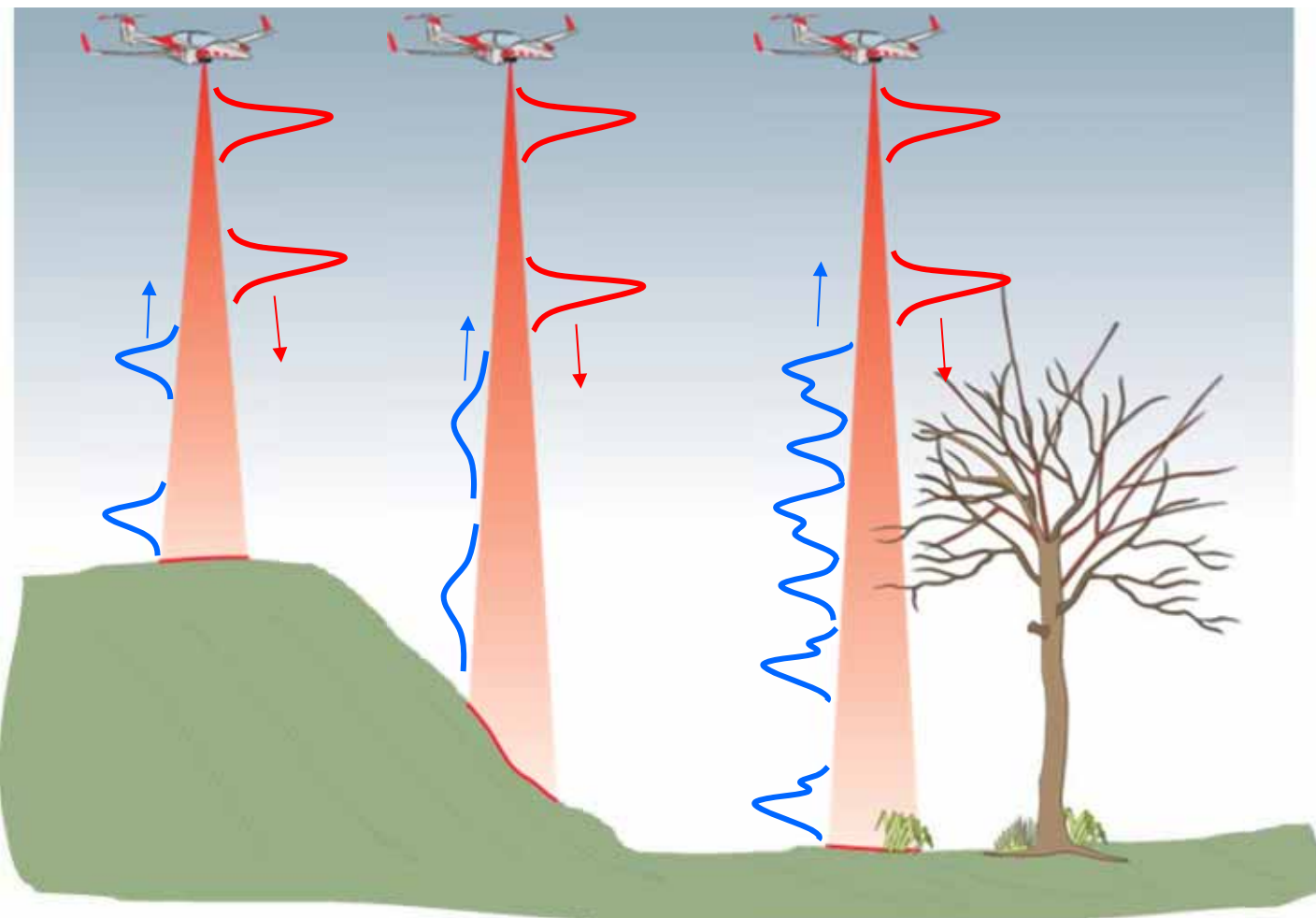
Flight plan – Sopron 2011



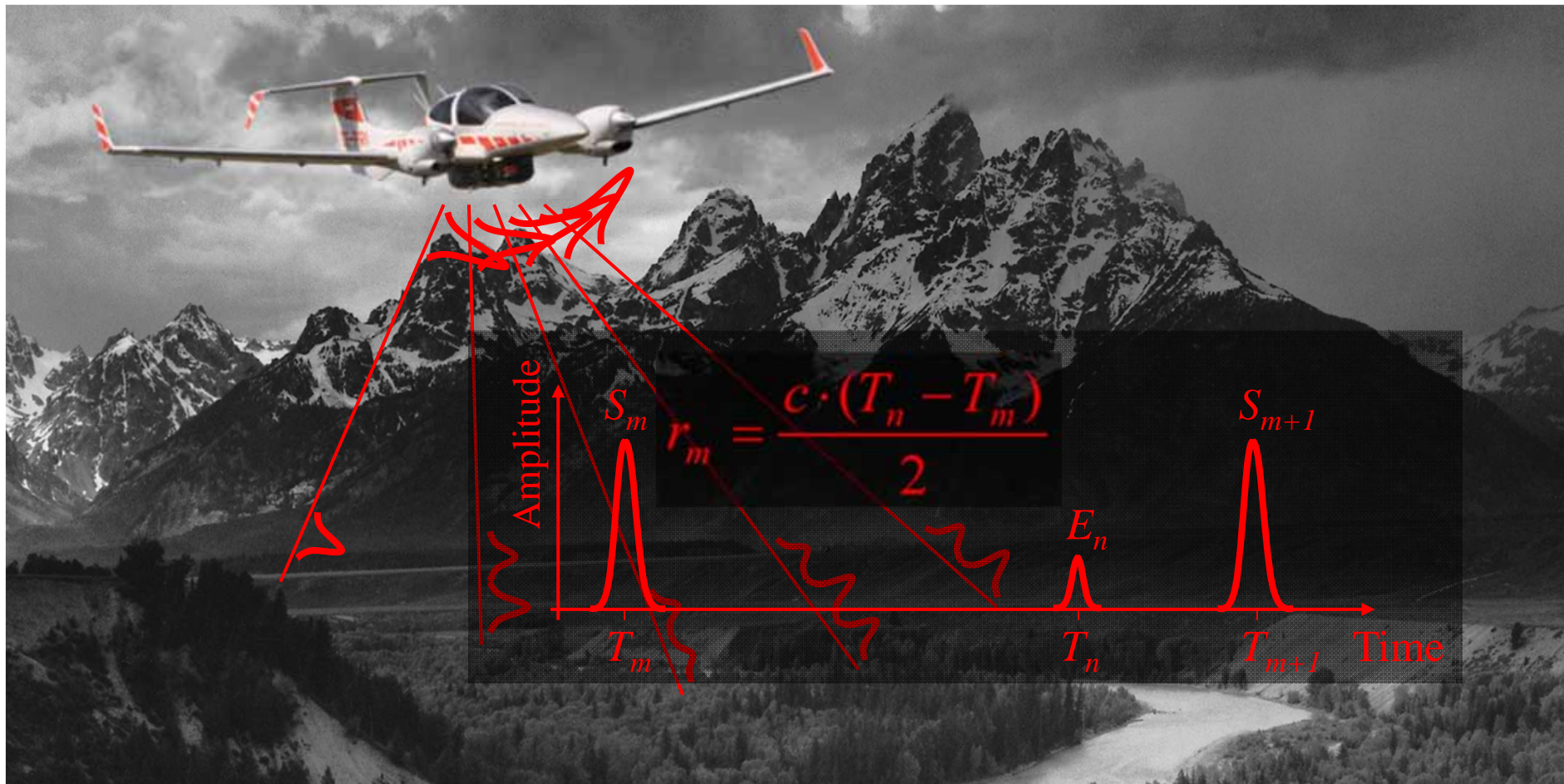
RiPROCESS Key Features:

- Project oriented data management
- Parallel data processing in LAN's
- Fast visualization of large areas
- System calibration
- Spatial transformation and projection

ALS Data Processing Workflow



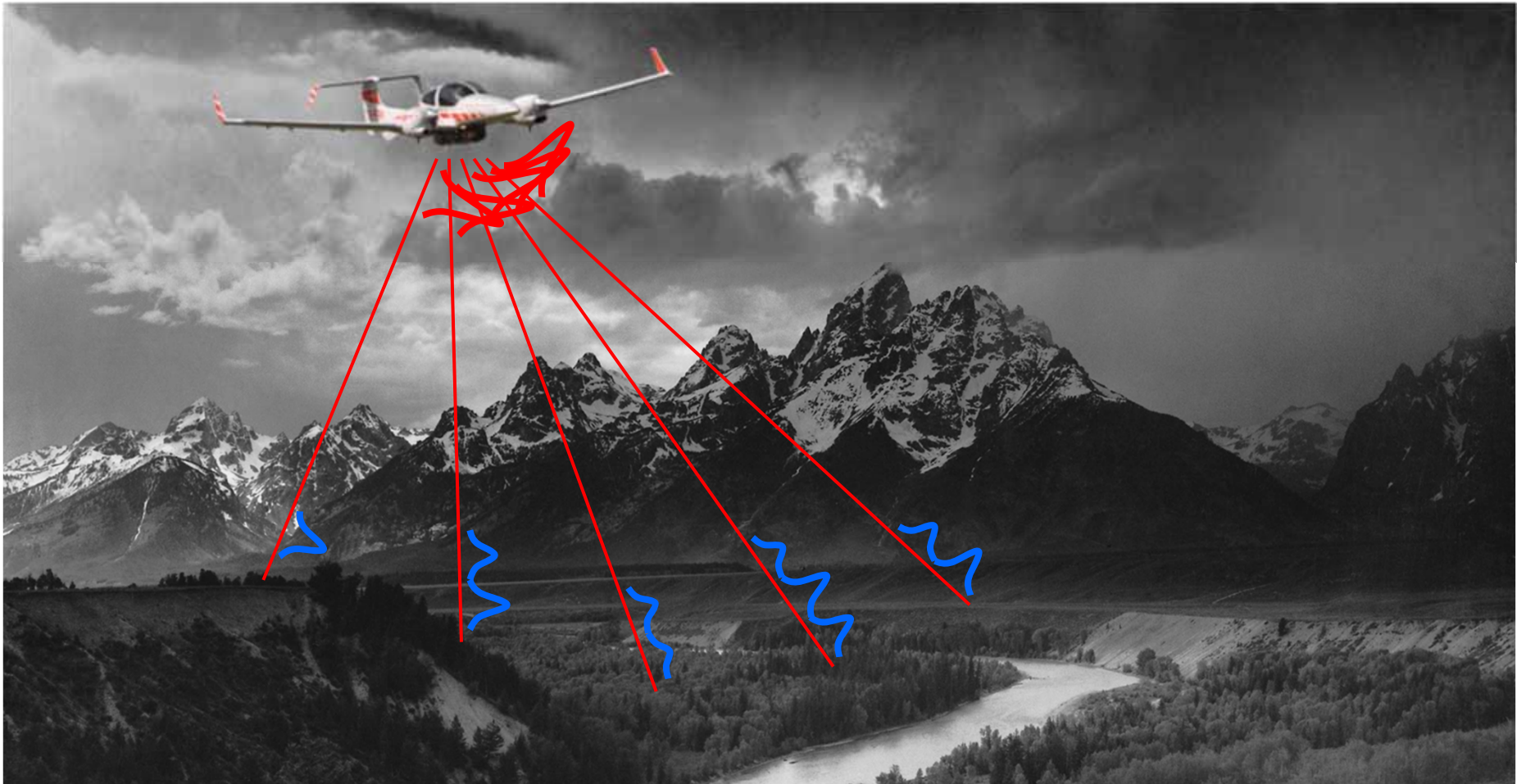
Full Waveform Data Acquisition

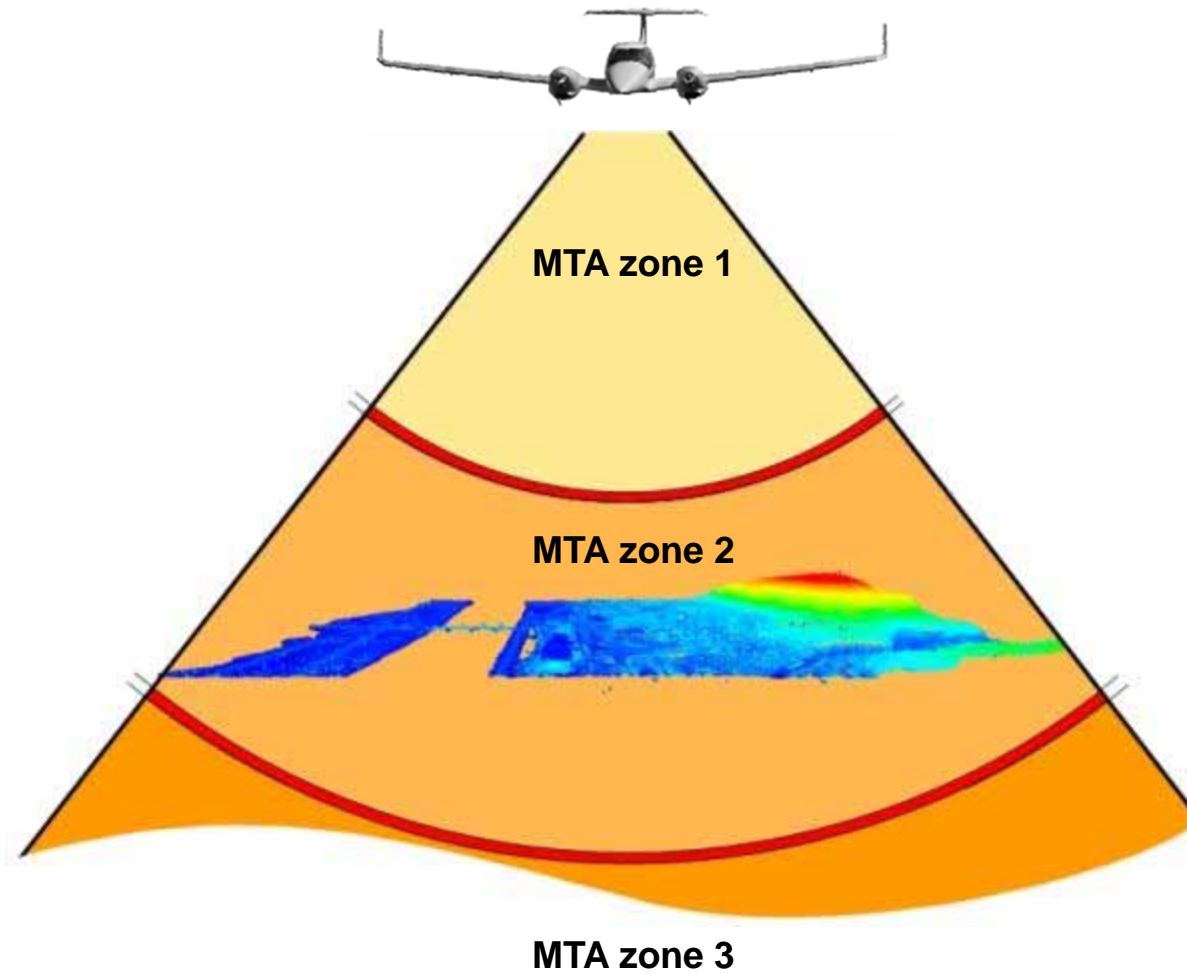


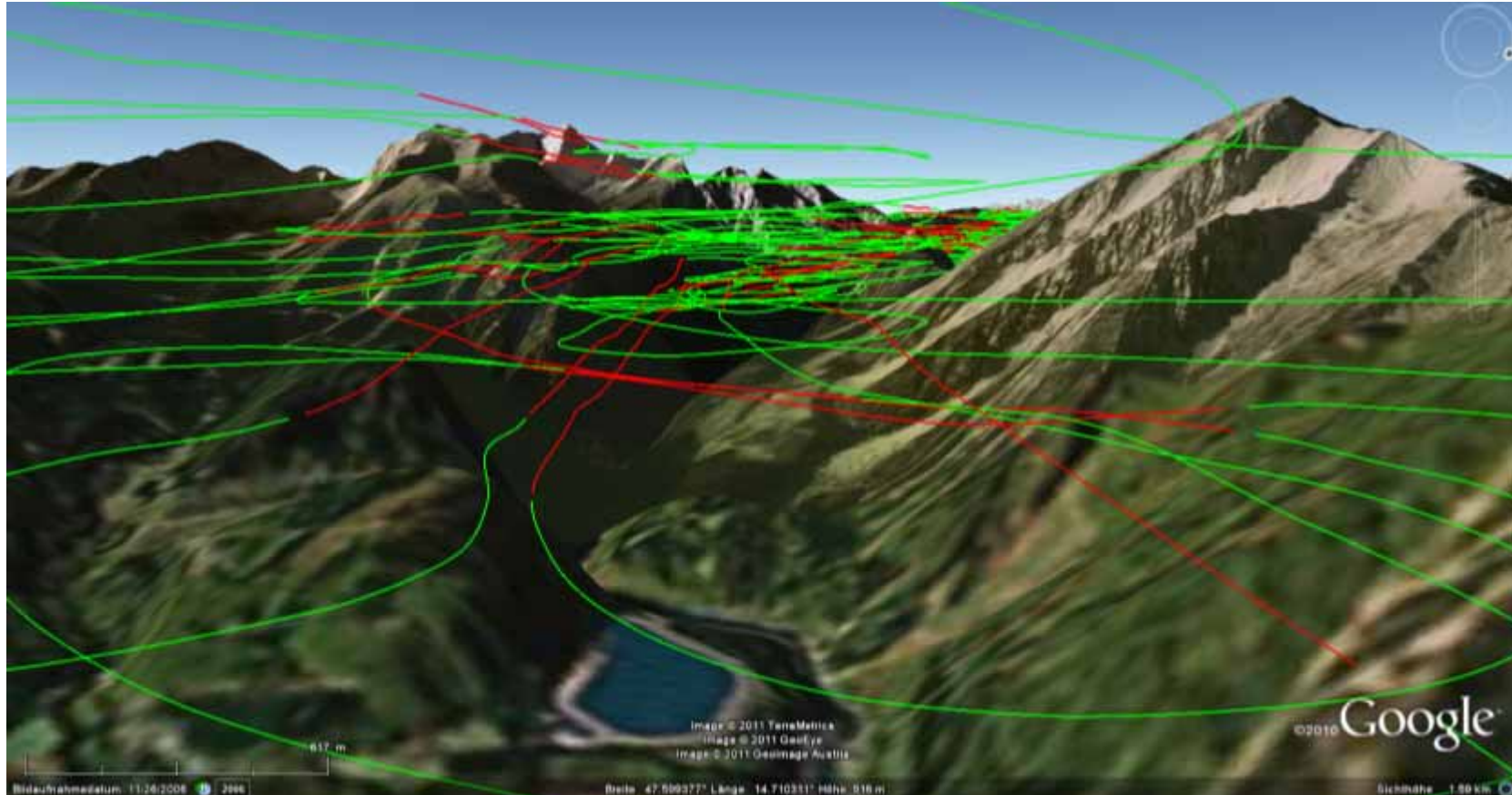


Multiple-Time-Around processing







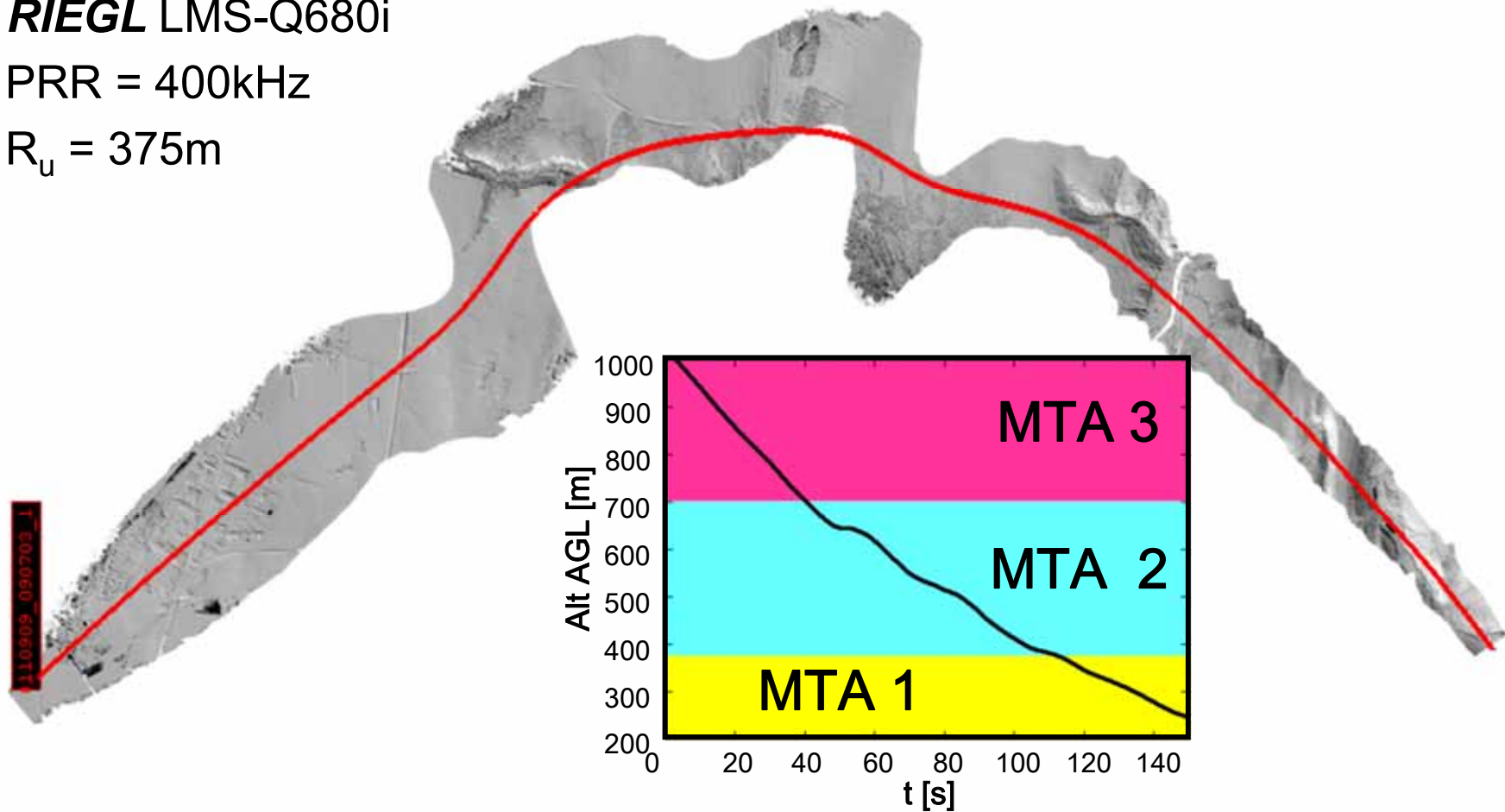




RIEGL LMS-Q680i

PRR = 400kHz

$R_u = 375\text{m}$

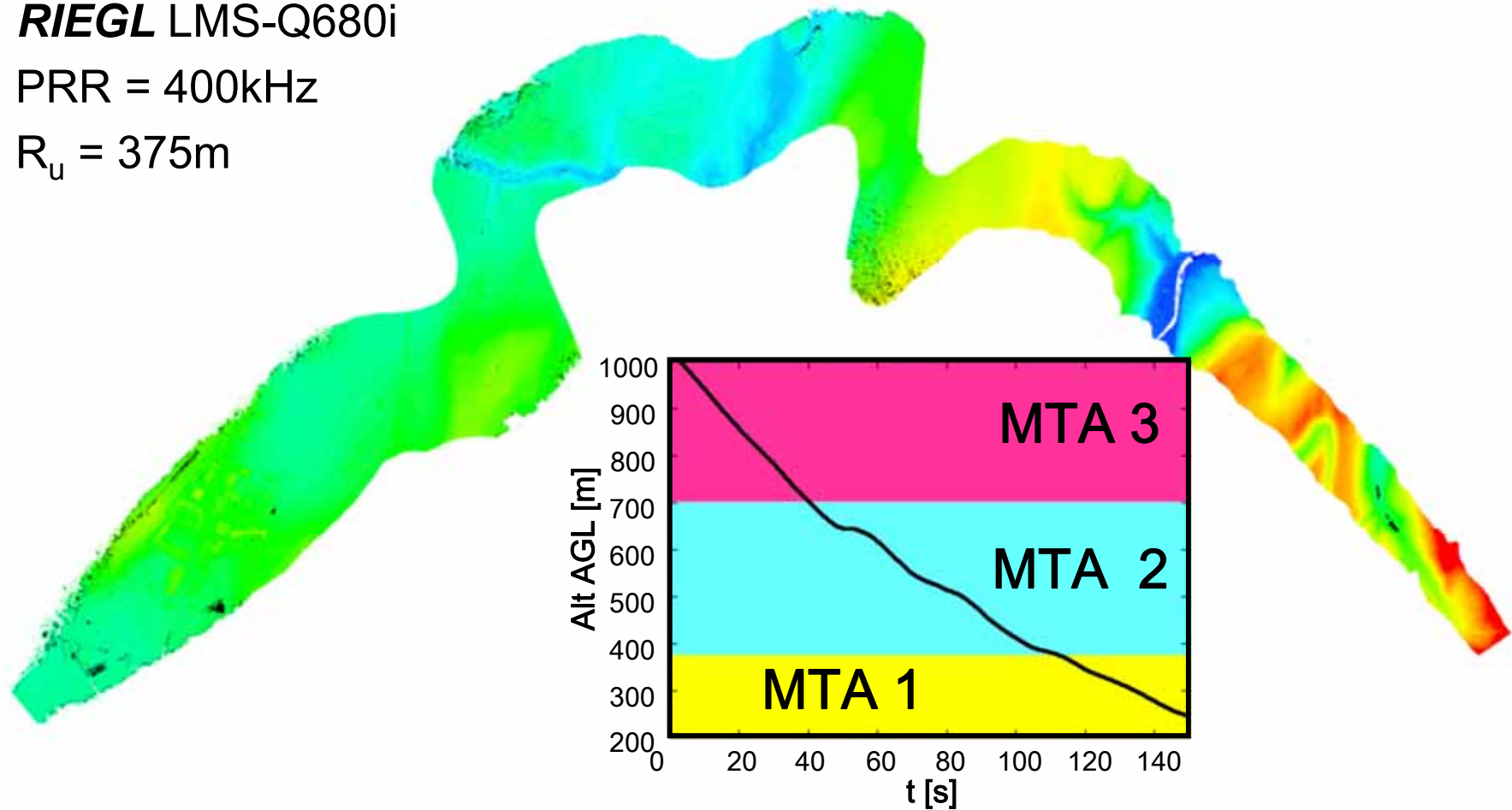




RIEGL LMS-Q680i

PRR = 400kHz

$R_u = 375\text{m}$

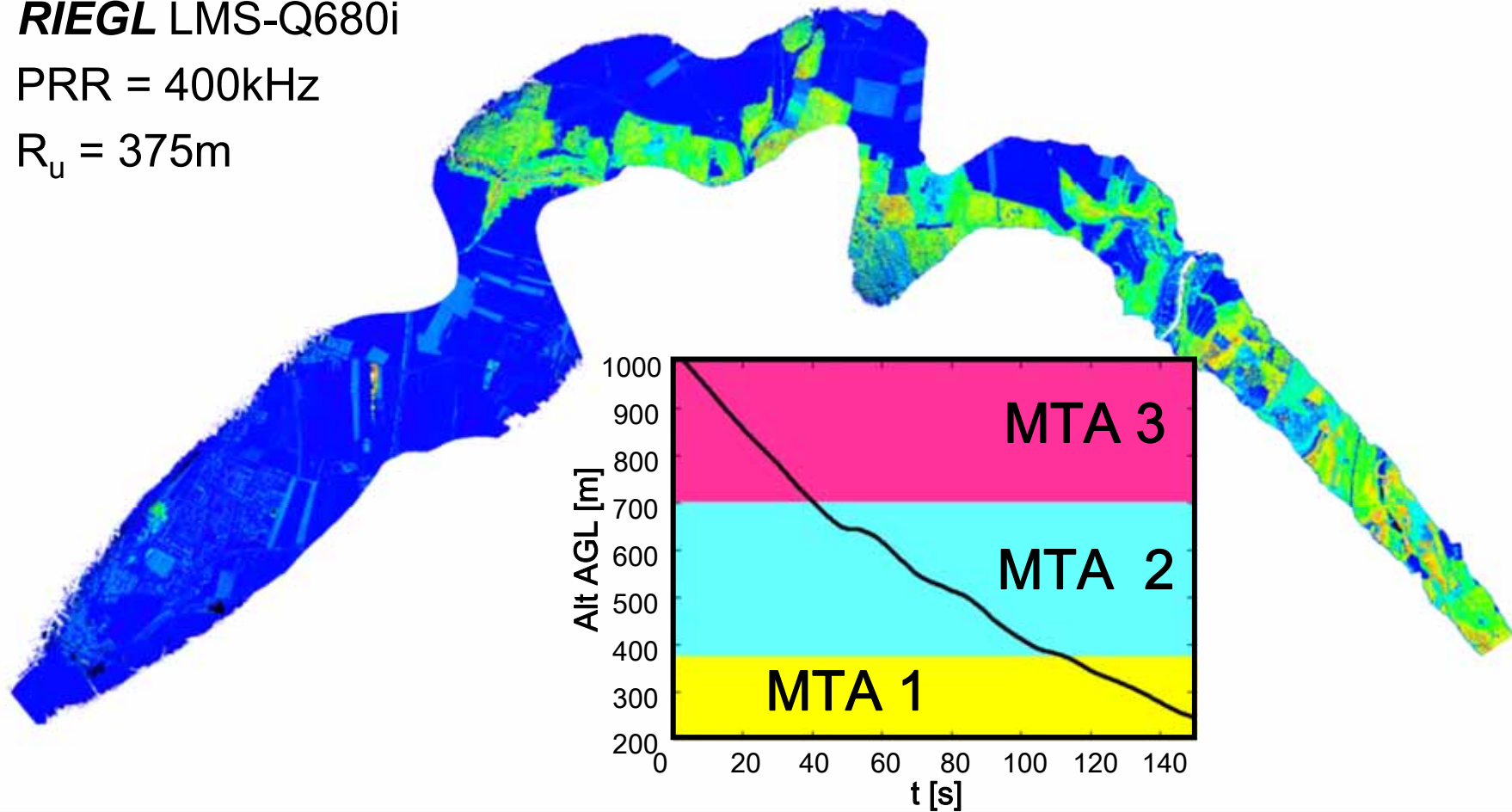




RIEGL LMS-Q680i

PRR = 400kHz

$R_u = 375\text{m}$

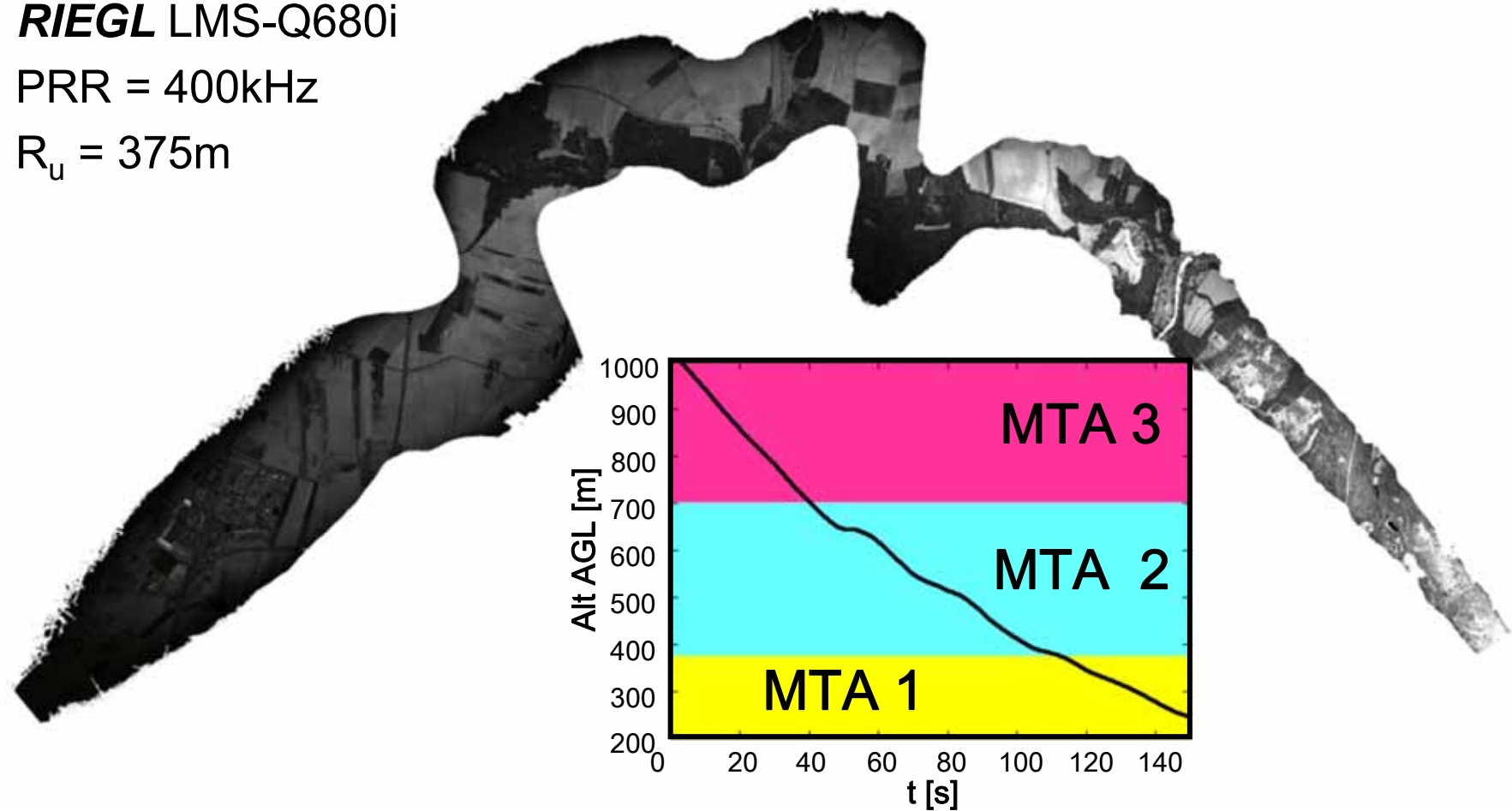




RIEGL LMS-Q680i

PRR = 400kHz

$R_u = 375m$

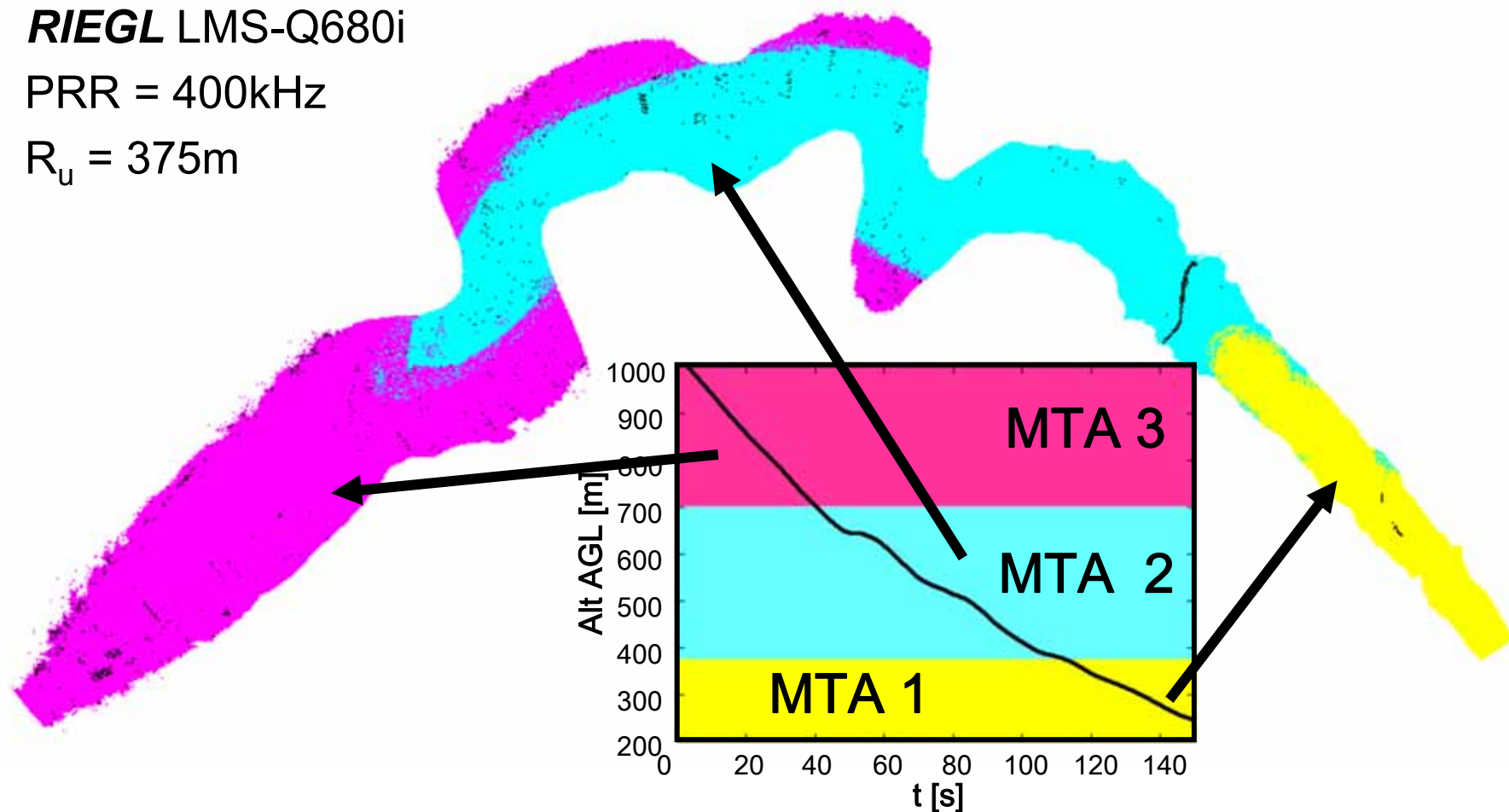




RIEGL LMS-Q680i

PRR = 400kHz

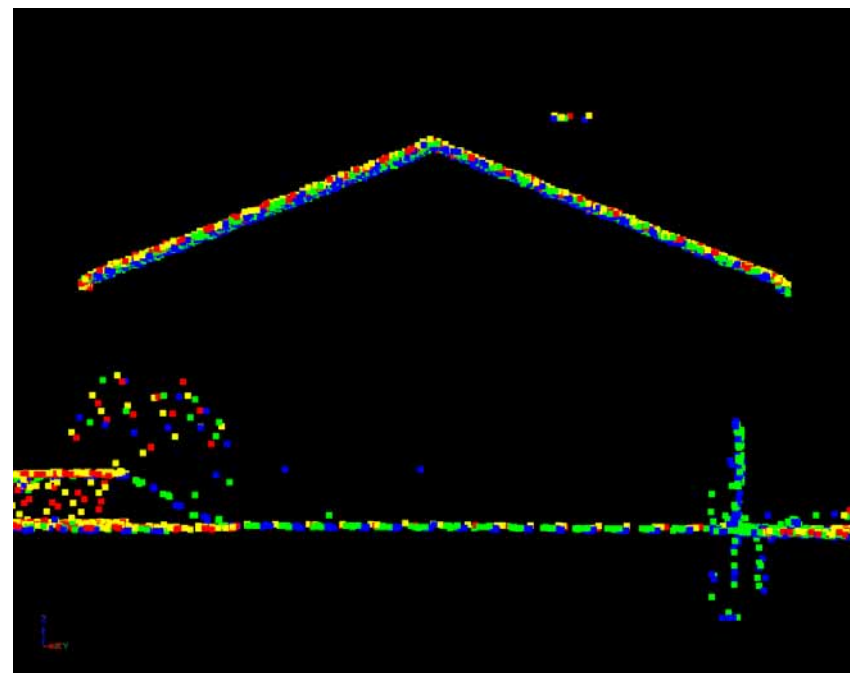
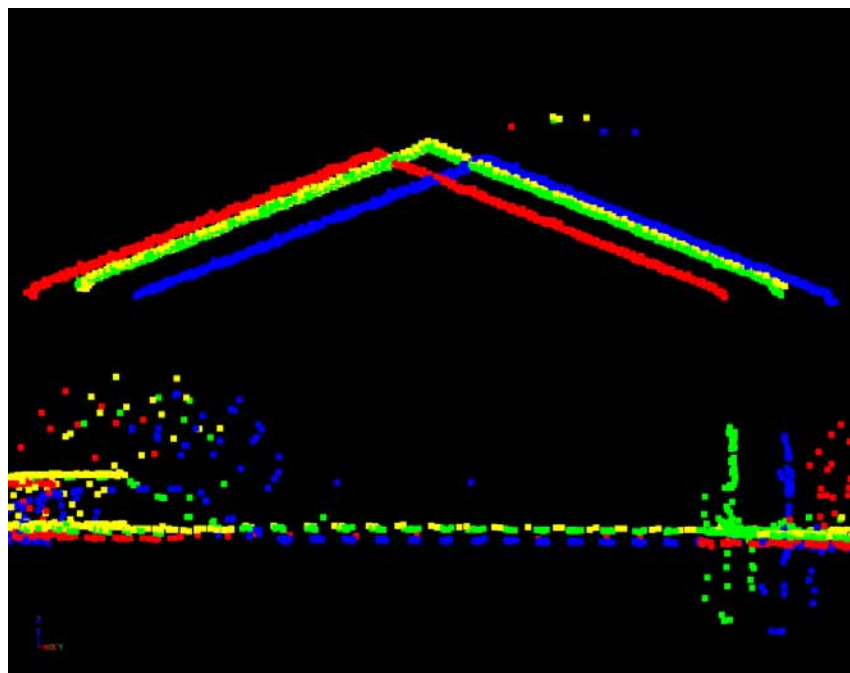
$R_u = 375m$



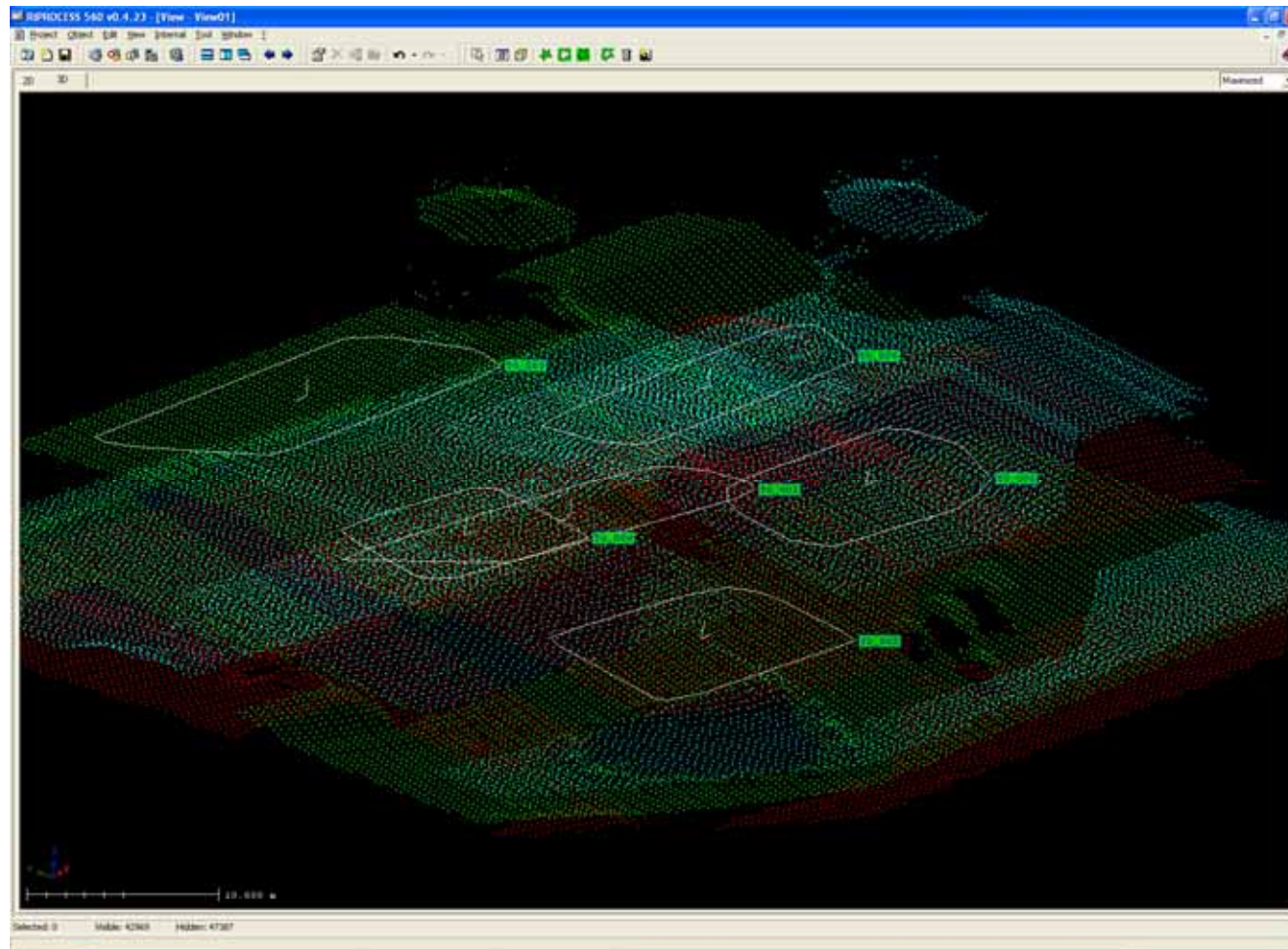


Scan Data Adjustment



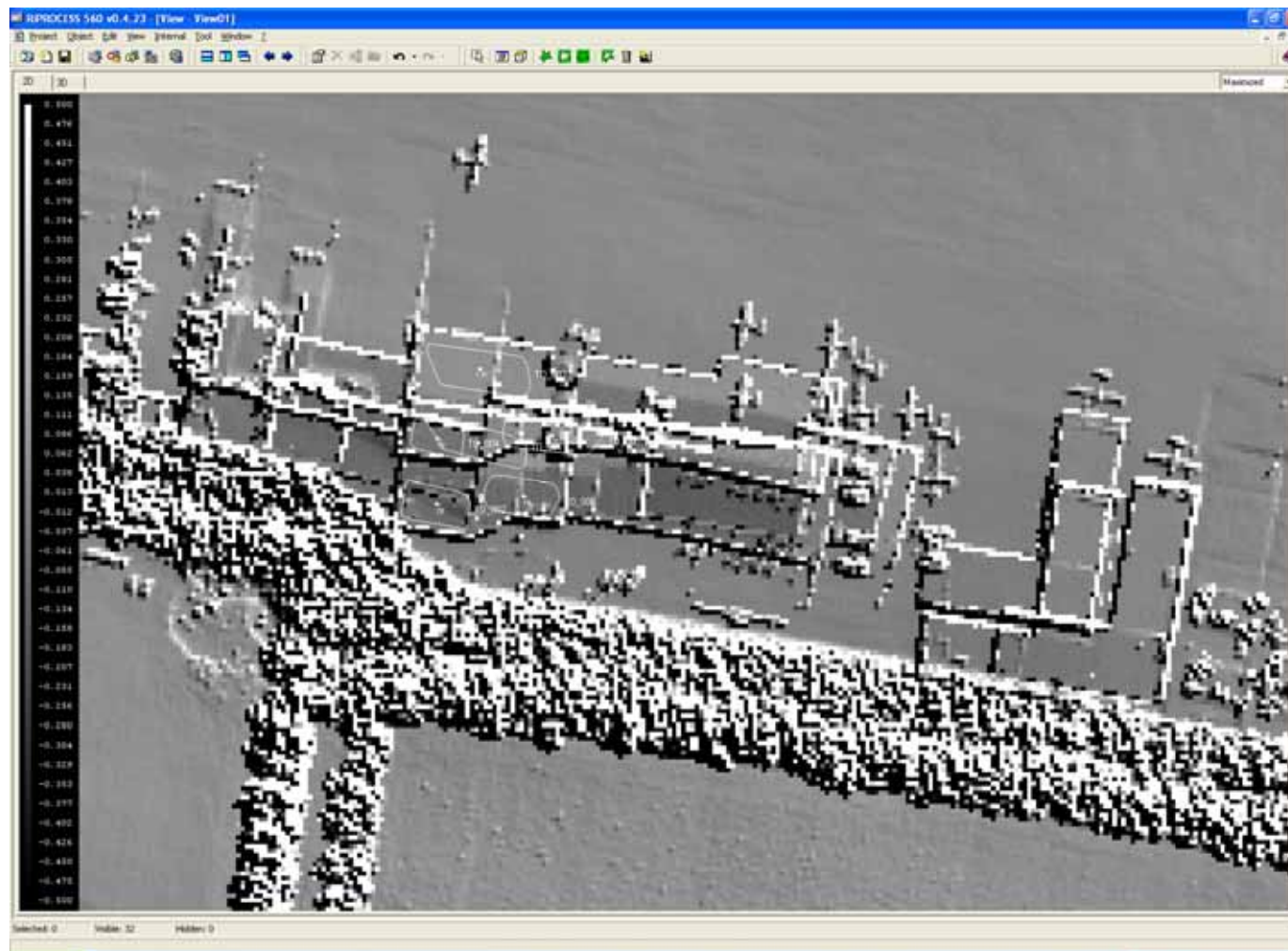


Before and after boresight adjustment





RIEGL
LASER MEASUREMENT SYSTEMS





070111_172024

Laser calibrations	Roll	Pitch	Yaw	F
Scanner Vorne	0.000	0.000	0.000	

ADJUSTMENT

Number of free parameters: 0

Number of observations: 99

Error (Std. deviation) [m] 6.1784

Create calibration files

Object 2	Deviation [m]
	-15.637
	-14.888
	13.455
	12.906
	12.616
	12.132
	11.751
	11.377
	11.109
	10.701
	-10.562



Laser calibrations

	Roll	Pitch	Yaw	F
Scanner Vorne	-0.612	1.228	-0.070	<input type="checkbox"/>

ADJUSTMENT

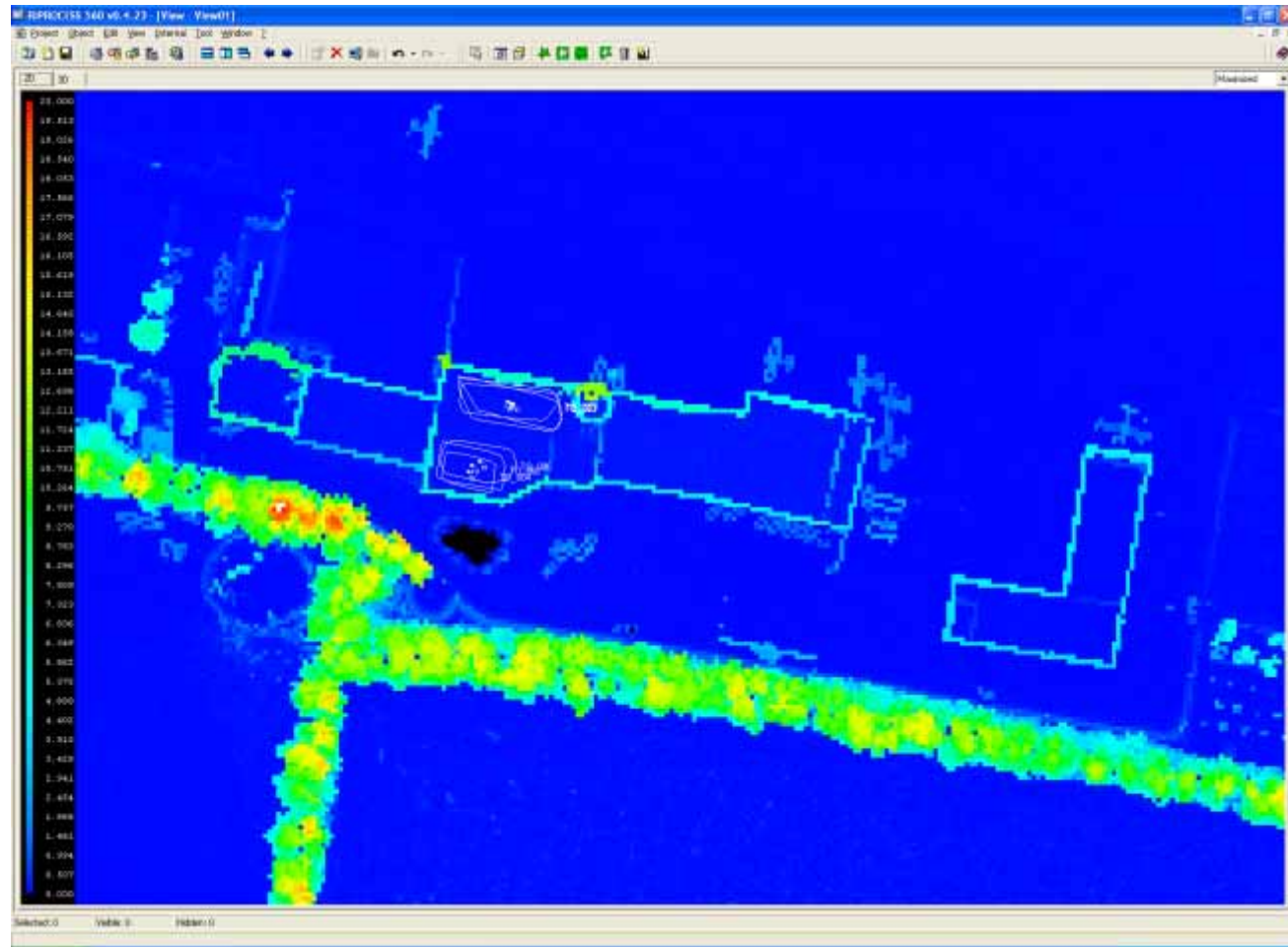
Number of free parameters: 3

Number of observations: 90

Error (Std. deviation) [m]: 0.0436

Create calibration files

Client ID	Deviation [m]
TO_008	-0.155
TO_014	-0.105
TO_021	-0.095
TO_009	0.069
TO_008	0.069
TO_014	-0.069
TO_008	0.059
TO_014	-0.058
TO_021	-0.057
TO_008	0.057





RIEGL LMS-680i

www.youtube.com/watch?v=TiM4n7rMTMk

ALS Movie