Airborne Laser Scanning Software

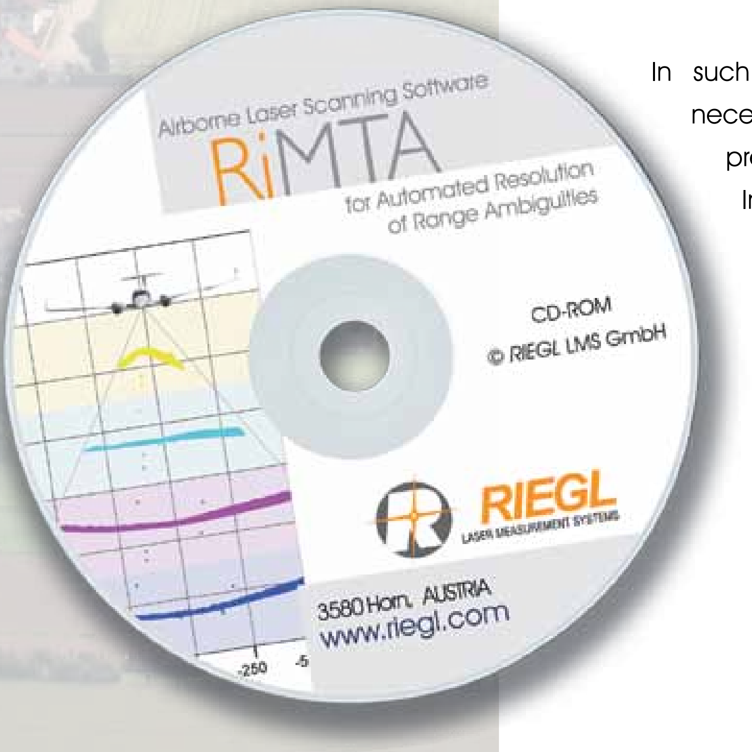
RiMTA

for Automated Resolution of Range Ambiguities

- *automatic resolution of range ambiguity in time-of-flight ranging*
- *unlimited number of MTA zones*
- *processes data acquired with RIEGL airborne laser scanners with MTA-processing capabilities*
- *smoothly integrated in the RIEGL data processing workflow*

Acquiring data in airborne laser scanning with high measurement rates from high altitudes frequently results in range ambiguities. Instruments with multiple-time-around capability (MTA) like the LMS-Q680i or the LMS-Q780 provide data that can be utilized to resolve these ambiguities in post-processing. Instead of manually specifying the correct MTA zone for range calculation, RiMTA will detect the correct MTA zone for each measurement automatically.

Correct determination of a measurement range with LIDAR instruments using time-of-flight measurements with short laser pulses requires the assignment of each received echo pulse to its causative emitted laser pulse. However, at high pulse repetition rates (PRR) and large measurement ranges this definite assignment becomes ambiguous due to a limiting factor which may not be tweaked by engineers' skills: the speed of light. At a PRR of e.g., 400 kHz the range of unambiguity is exceeded after only 375 meters, a measurement distance which is routinely exceeded in airborne laser scanning (ALS).



In such cases, target echoes received may not necessarily be associated with the immediately preceding laser pulse emitted (MTA-zone 1). Instead they may be associated with any of the previous laser pulses emitted. Therefore it is necessary to correctly identify each pulse echo with its correct originating laser emission.

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RIEGL® LASER MEASUREMENT SYSTEMS

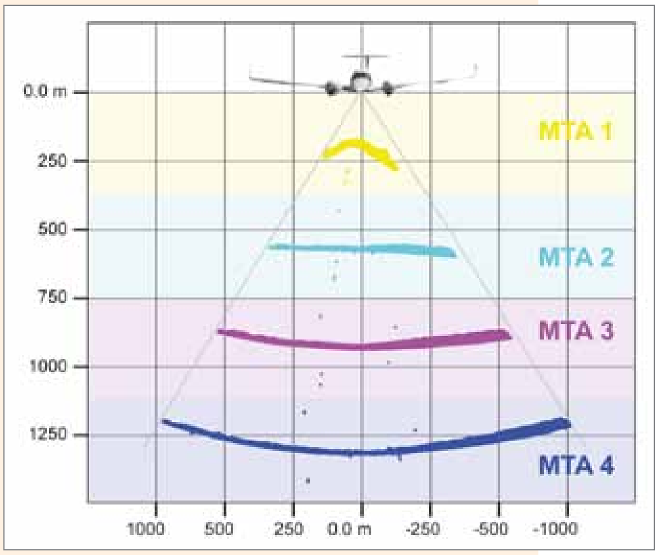

Fig. 1 Profile of scan data processed in MTA zones 1 to 4 (data acquired by RIEGL LMS-Q680i laser scanner)

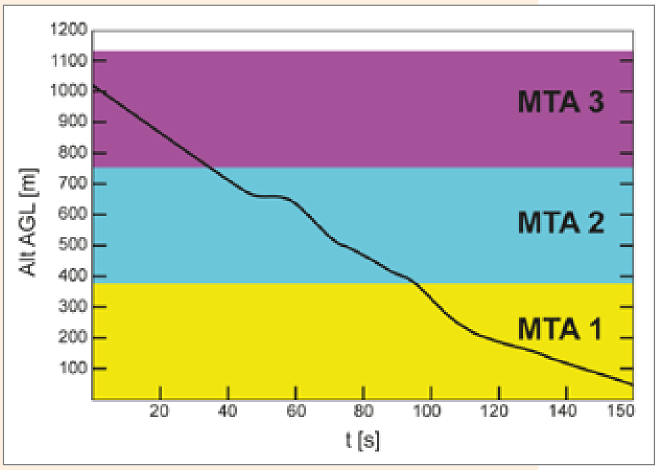

Fig. 2 Flight altitude above ground level descending from 1,000 m to 240 m within 150 seconds

Figure 1 provides a visual demonstration of ALS data where each target echo has been calculated utilizing four of the immediately previous laser pulses emitted. This means that each single echo is represented by a measurement range calculated in MTA zone 1, 2, 3 and 4 respectively. In reality only one of the four realizations represents the true point cloud model of the scanned earth surface. The chosen example shows that the scan data is correctly allocated to MTA zone 2, where the earth surface appears consistently flat. This result stands in contrast to the typical spatial characteristics of incorrectly calculated ambiguous ranges in MTA zones 1, 3 and 4.

Unique techniques in high-speed signal processing and a novel modulation scheme applied to the train of emitted laser pulses permit range measurements without any gaps at any distance within the instrument's maximum measurement range. The specific modulation scheme applied to the train of emitted laser pulses avoids a total loss of data at the transitions between MTA-zones and retains range measurement at approximately half the point density.

The correct resolution of ambiguous echo ranges is accomplished using RiMTA in tandem with SDCImport and RiANALYZE for an optimized workflow that maintains fast processing speed for mass data production.

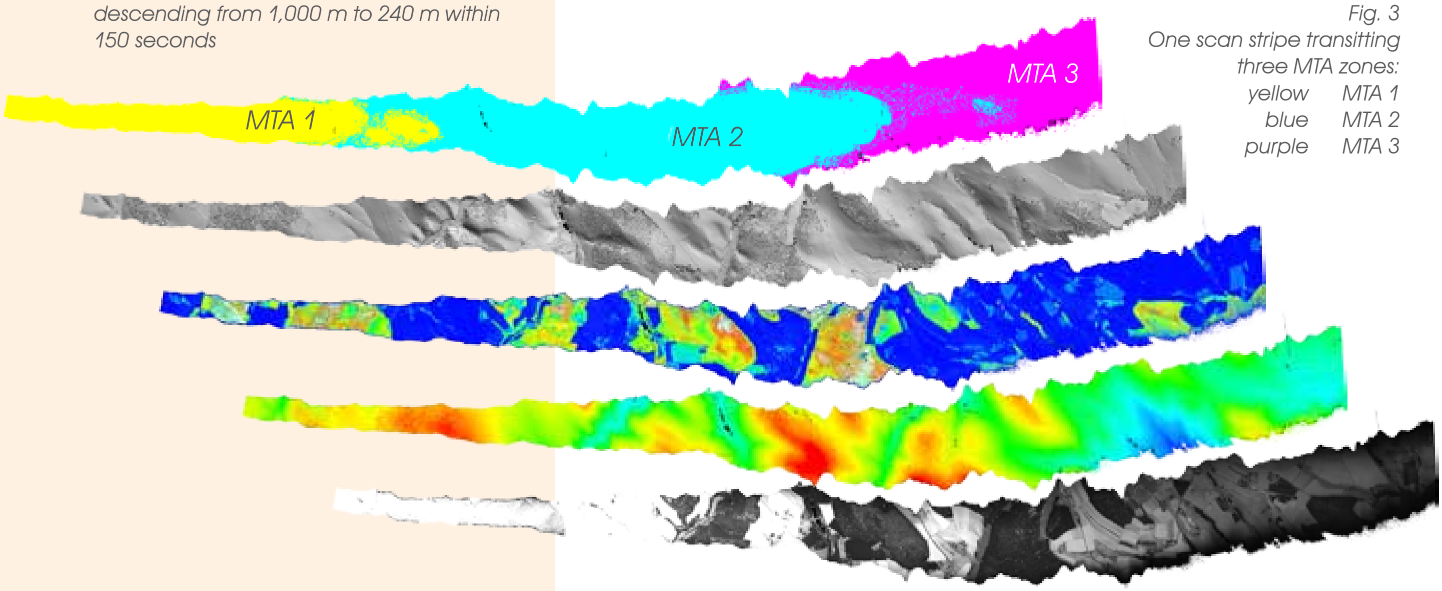

Fig. 3 One scan stripe transitting three MTA zones: yellow MTA 1, blue MTA 2, purple MTA 3

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