Terrestrial Laser Scanning Software

RiMTA TLS

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 VZ-1000, VZ-2000, VZ-4000, VZ-6000, and VZ-400i laser scanners*
- *smoothly integrated into the RIEGL data processing workflow*

Acquiring data in terrestrial laser scanning with high measurement rates over long ranges frequently results in range ambiguities. Instruments with multiple-time-around capability (MTA), like the *RIEGL* VZ-4000, include information in the acquired data which the RiMTA TLS utilizes to resolve these ambiguities. Instead of requiring users to manually specify the correct MTA zone for each data set or even subset of data, RiMTA TLS automatically calculates the MTA zone for each measurement.

In order to correctly determine the range to a target with a LIDAR instrument using time-of-flight measurements with short laser pulse intervals, it is necessary to correctly determine the correlation of each received echo pulse to its causative emitted laser pulse. At high pulse repetition rates (PRR and large target ranges this definite allocation becomes ambiguous due to a limiting factor which may not be tweaked by engineer's skills: the speed of light. At a PRR of 300 kHz the range of unambiguity is 500 meters, a measurement distance which is routinely exceeded by *RIEGL* terrestrial laser scanners (TLS). For more range ambiguity examples, see table in figure 1 on the following page.

In such cases, received target echoes may not necessarily be associated with the immediately preceding laser pulse emitted (MTA-zone 1). Instead, they may be associated with any laser pulses preceding it (MTA zones 2-∞). For correct ranging it is therefore mandatory to correlate each pulse echo with its correct originating laser pulse.

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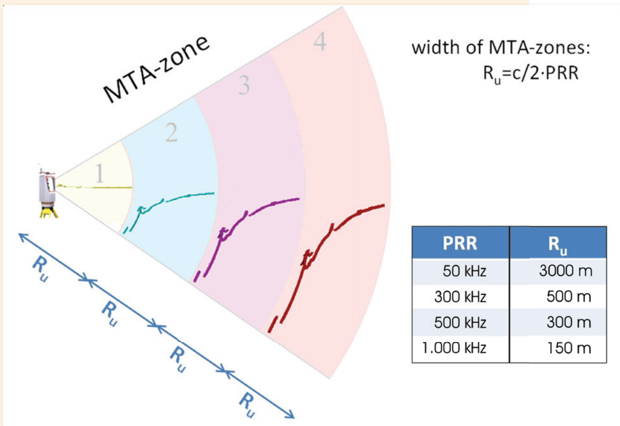

Fig. 1 Profile of scan data physically present in MTA zone 1 shown as manually processed in MTA zones 1-4

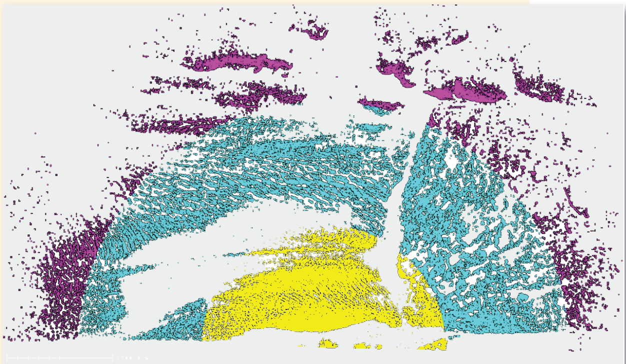

Fig. 2 Top view of data acquired by RIEGL VZ-6000 at 50 kHz with data from 3 different MTA zones

Terrestrial scanning, in contrast to airborne laser scanning, introduces an additional level of complexity in the resolution of such ranging ambiguities. It is possible that a single laser pulse encounters multiple targets, e.g., in the near field and far field, which results in multiple echoes in multiple MTA zones from a single emitted pulse. Therefore, the resolution of these ambiguities has to be carried out strictly on an echo-to-echo basis and not simply on a laser shot basis. In a final automatic step, outliers are removed according to a confidence filtering test for each resulting point.

RIEGL utilizes a novel modulation scheme to the train of emitted laser pulses and unique techniques in high-speed signal processing which enables range measurements without any notable gaps between the MTA zones within the instrument‘s maximum measurement range. For an optimized workflow, RiMTA TLS is seamlessly integrated into RiSCAN PRO, maintaining fast processing speeds for mass data production.

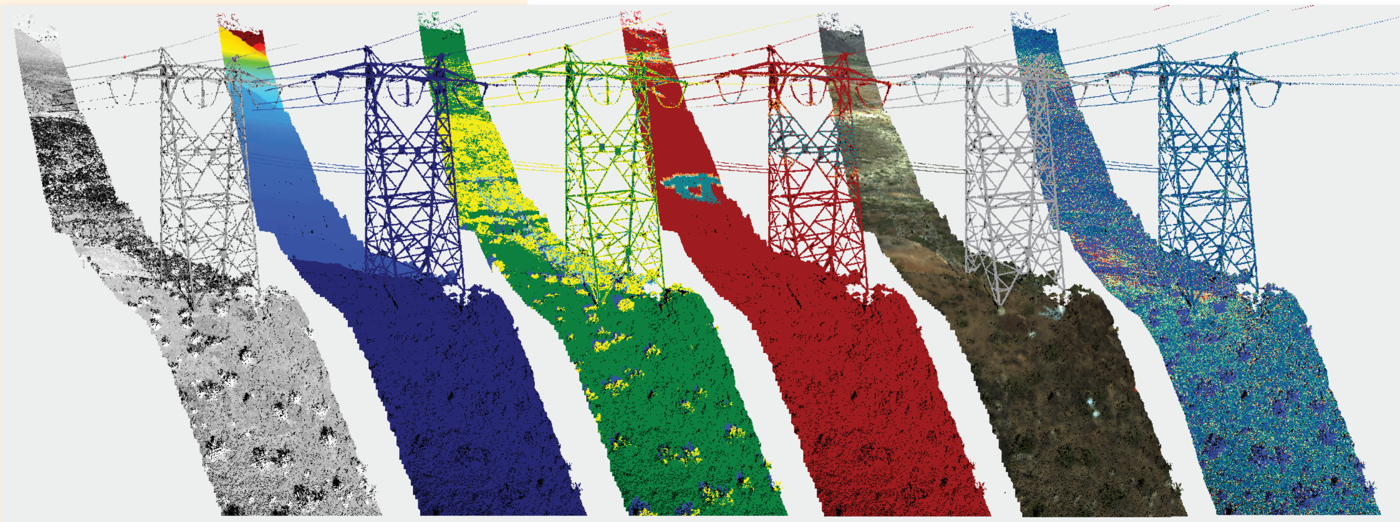

Fig. 3 Data visualized by (from left to right) reflectance, target range, multiple echoes ID, MTA confidence, true color, and pulse shape deviation

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RIEGL Laser Measurement Systems GmbH
Riedenburgstraße 48
3580 Horn, Austria
Phone: +43 2982 4211 | Fax: +43 2982 4210
office@riegl.co.at
www.riegl.com

RIEGL USA Inc.
Orlando, Florida | info@rieglusa.com | www.rieglusa.com
RIEGL Japan Ltd.
Tokyo, Japan | info@riegl-japan.co.jp | www.riegl-japan.co.jp
RIEGL China Ltd.
Beijing, China | info@riegl.cn | www.riegl.cn

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