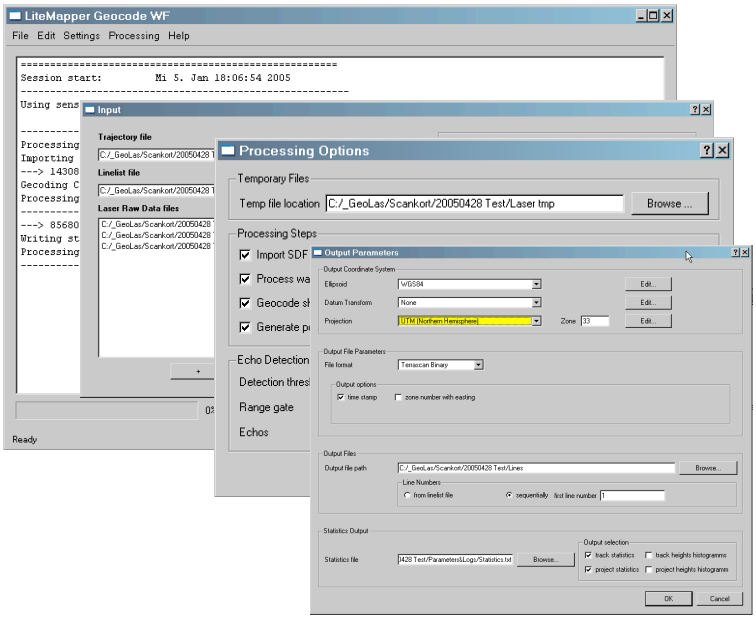
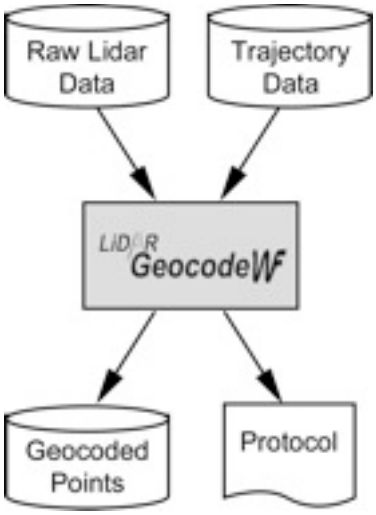
LiDAR GeocodeWF

GeocodeWF is the tool for converting the raw waveform data collected by *Riegl LMS-Q560 and LMS-Q680* laserscanner-based lidar systems into geocoded points in a projected coordinate system.

GeocodeWF is a stand-alone application that interfaces smoothly with *TerraScan* and other lidar post-processing tools. *GeocodeWF* reads native lidar waveform data recorded by the *Riegl DR560* data recorder, and pre-processed trajectory and attitude data, to calculate 3-D point coordinates in the selected geographical reference frame. Output is generated in the native binary format of the *TerraScan* lidar data post-processing software for rapid data transfer, or the *Calibrated Waveform* file format that combines geocoding information and indexed waveform data for subsequent processing.





GeocodeWF has been designed for ease-of-use and efficient production. After selection of the input files, processing and output parameters, it does not require further user interaction. All parameter settings may be saved to “flight” savesets for later reference and re-use. Also, a batch mode is available for processing data based one or several previously defined flight savesets, so that large projects can be efficiently processed over night.

Context sensitive online help on several levels supports and guides the user. During processing, parameters and process status are displayed and logged, and data statistics are generated for quality assurance purposes. The waveform analysis, transformation and projection algorithms have been optimized for speed to provide time-efficient geocoding of raw waveform data. Furthermore, the user has control over which processing steps are to be executed to minimize processing time during iterative processing segments. Furthermore, *GeocodeWF* includes a separate tool, the *SDFSplitter*, to extract data segments from large raw sample data files, so that time-intensive processing can be limited to the relevant sections.

To ensure the accuracy of the geocoding results *GeocodeWF* uses the full calibration information available from the *Riegl LMS–Q560/680* sensor. Installation offsets and line offsets may be entered to compensate for missalignment errors and GPS-effected variations in the trajectory, and to therby further maximize the geometrical fidelity of the generated data products. Environmental parameters (air pressure, temperature, relative humidity) may be taken into account to compensate variations of the speed-of-light due to atmospheric conditions, to enhance measurement accuracy further.

Currently, transversal-mercator-type projected coordinate systems (UTM, Gauss-Krueger) are available, whereby the user can select from a number of pre-defined ellipsoids, datums, and projection parameters, or define his own. Other projection types can be implemented upon request.

Features

- Reads native binary lidar sample data files (SDF) and trajectory and attitude data files.
- Detects surface returns in echo waveforms and determines the accurate location of the return.
- Provides true surface reflectance at the laser wavelength by scaling return intensity with range.
- Outputs pulse widening for surface slope and roughness analysis and classification.
- Selection of preset and user-defined ellipsoids, datums, and projections available.
- Output format in ASCII, native Terrascan Binary, LAS binary format or as geocoded *Calibrated Waveform* files.
- Generation of processing protocol and output data statistics for quality control.
- Batch processing of multiple survey flights using flight parameter savesets
- Incremental flight parameter sets can be used for modifying only few parameters
- Uses lidar sensor specific calibration files for improved accuracy, or standard calibration parameters of SDF files
- Provides control over installation-specific boresight offsets.

Included tools

- *GeocodeWF* application
- *SDFSplitter* utility

File Input

- Single or multiple binary sample data files (.SDF) from LMS-Q560 and LMS-Q680(i) series laserscanners
- Binary or ASCII lidar trajectory and orientation files (.LPO, .POS, SBET (*.out)).
- Lidar sensor description/calibration files
- Flightplan files for automatic output filename assignment and line adjustment

File Output

Available output formats:

- ASCII point records (.ASC)
- Terrascan binary format (.BIN)
- LAS1.0 and 1.1 binary formats (.LAS)
- GeocodeWF binary point format (.GKW)
- GeocodeWF binary geocoding and calibrated waveform file format (.LGC, .LWF)
- Terrascan binary trajectory format (.TRJ) for geocoded trajectory or segments output

User settings

- Installation offsets for
  - boresight angles,
  - translational offsets,
  - timing offsets
- Atmospheric conditions
- Sensitivity of echo detection
- Return selection (first, unlimited number of intermediate, last return of each laser shot)
- Range gate
- Output ellipsoid, datum, map projection
- Definition of custom ellipsoids, datum transforms, and map projections
- Output file type, path
- Statistics output

System Requirements

- Hardware:
  - Intel/AMD based computer
  - NTFS-formated harddrive for file sizes larger than 4GB.
  - 256 MB RAM
  - Supports parallel processing on Intel multi-core / hyperthreading CPUs
- Operating system:
  - Windows XP (SP 2)

Maintenance & Support

- 12 months of free maintenance (bugfixes and updates) and e-mail support included.

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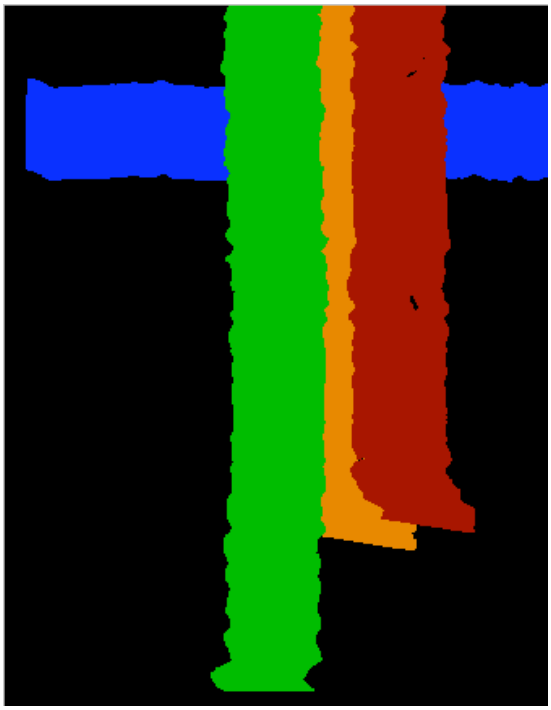
GeocodeWF Advantages
„Thinning“

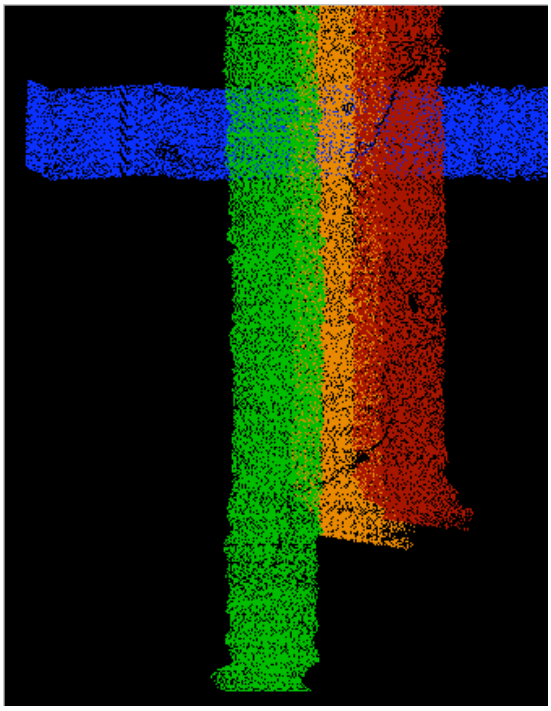
Thinning provides a way to produce Quicklook data rapidly for coverage and quality control immediately after a survey flight.

Thinning may also be used to only generate the edge points of flight lines to quickly obtain an overview of track layout, coverage, and overlap.

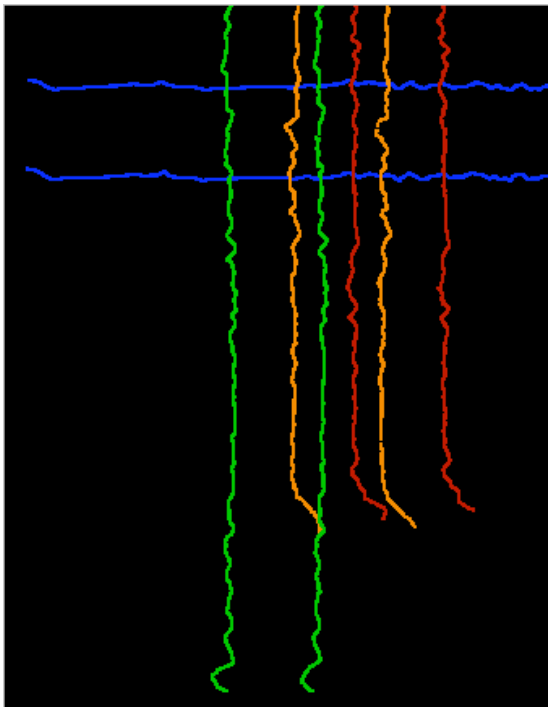
GeocodeWF lets the user select a thinning factor for a first geocoding run, reducing the number of shots needing to be processed and thus speeding up processing drastically, especially in single-pass mode.



All points processed



Every 100th point processed



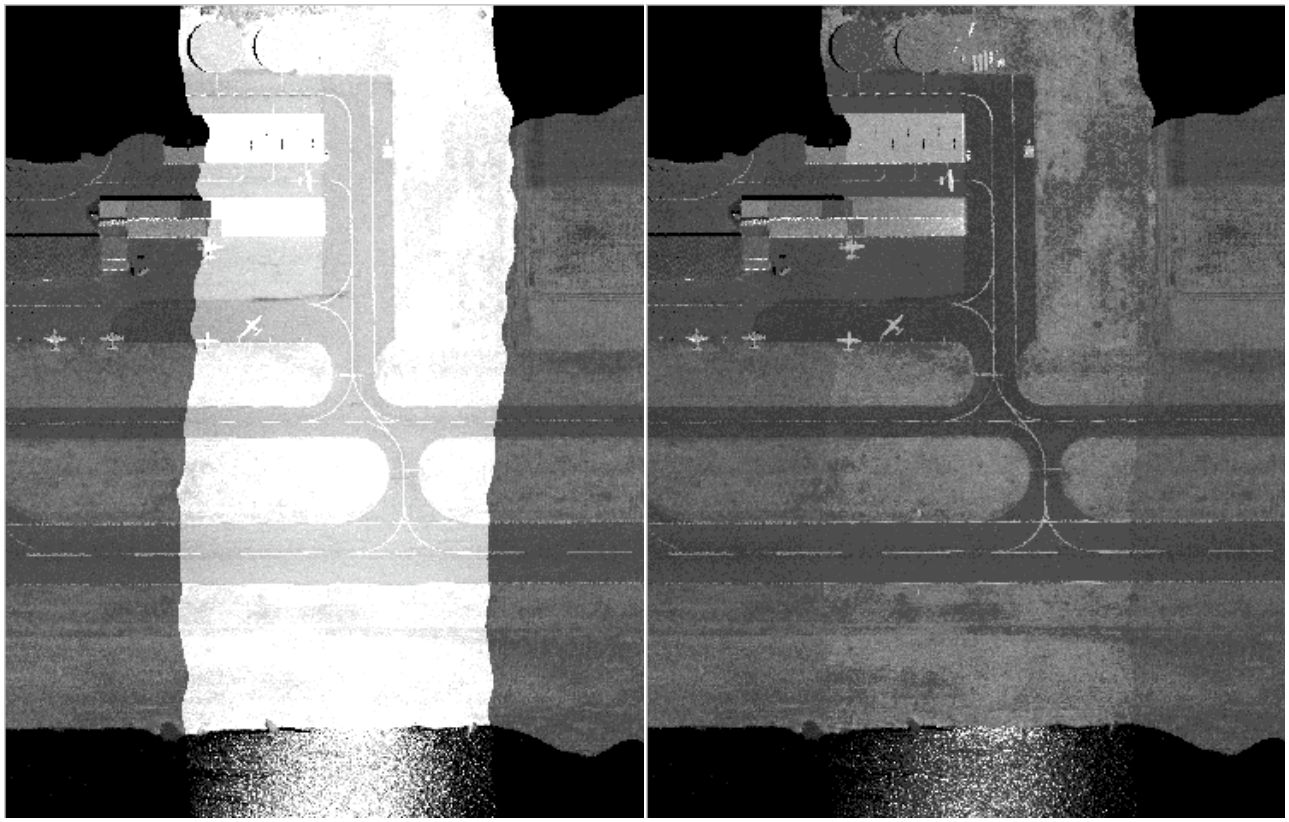
Only track edge points processed

GeocodeWF Advantages
„Range-corrected Intensity“

Range-corrected Intensity output compensates range-dependece of raw intensity values, so that the intensity image reflects surface reflectance more accurately, independently of flying altitude.

The images show the effect - the vertical flight line was flown at a lower altitude than the horizontal flight line, so raw intensity is much larger in the vertical flight line. With range-corrected intensity activated, barely any effect of altitude on intensity is left in the image on the right.

Surface classification based on intensity thus becomes more feasible and reliable.



Uncorrected intensity

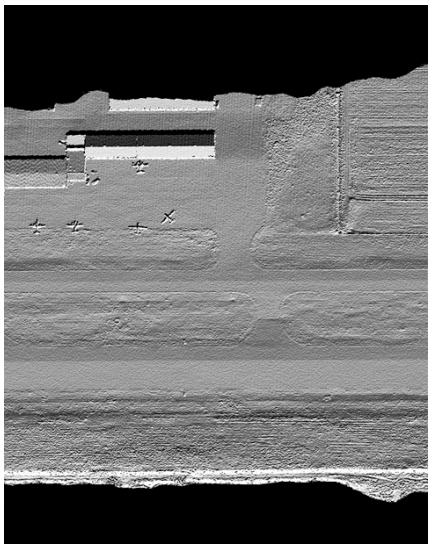
Range-corrected intensity

GeocodeWF Advantages
„Pulse width“

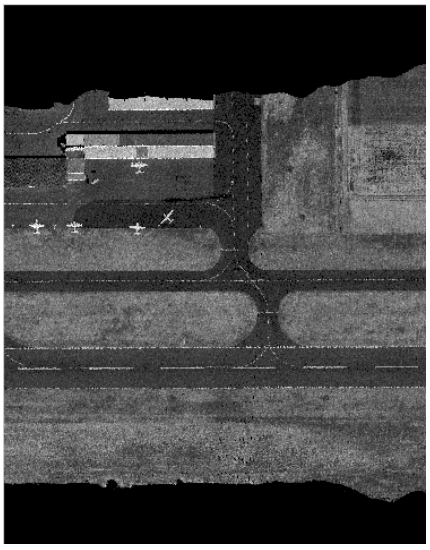
Pulse witdh output directly gives an impression of surface roughness and surface slope (relative to the measurement beam).

GeocodeWF is able to output relative pulse width (pulse spreading) down to a fraction of the outgoing pulse width. Surface slope differences of down to 10° can be distinguished (roofs), and differences in surface roughness become visible to allow rapid distinction of artificial (flat) surfaces vs. surfaces with low vegetation (grass).

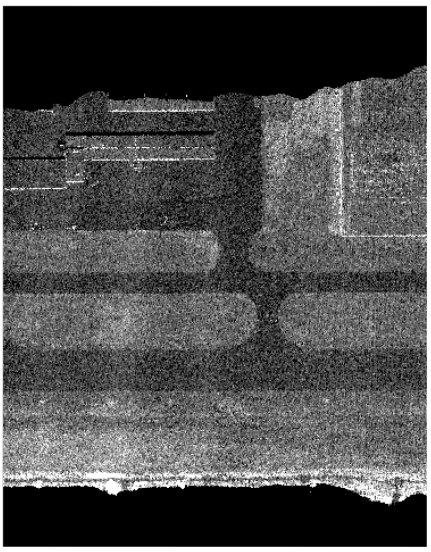
Also, the height of low vegetation can be determined more accurately this way than with any other remote sensing technique.



Shaded relief



Intensity



Pulse width (surface roughness/ slope)

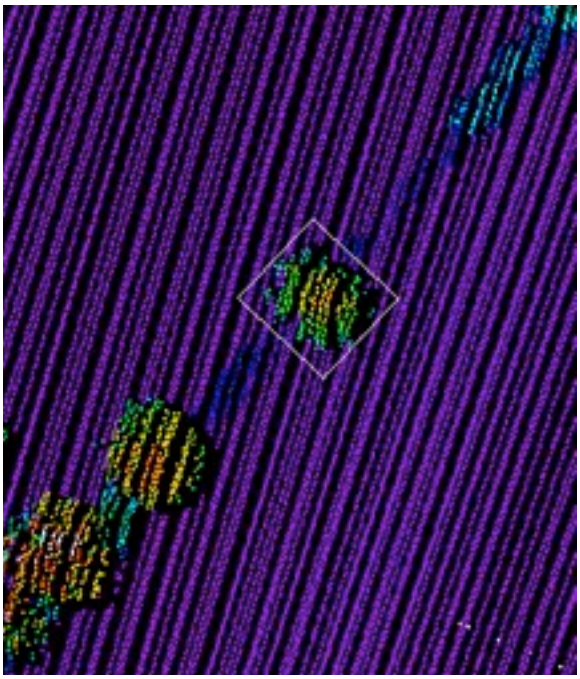
GeocodeWF Advantages
„Geocoded Calibrated Waveform“

GeocodeWF is the only processing software on the market that gives the user access to actual waveform data of the LMS-Q560 laserscanner.

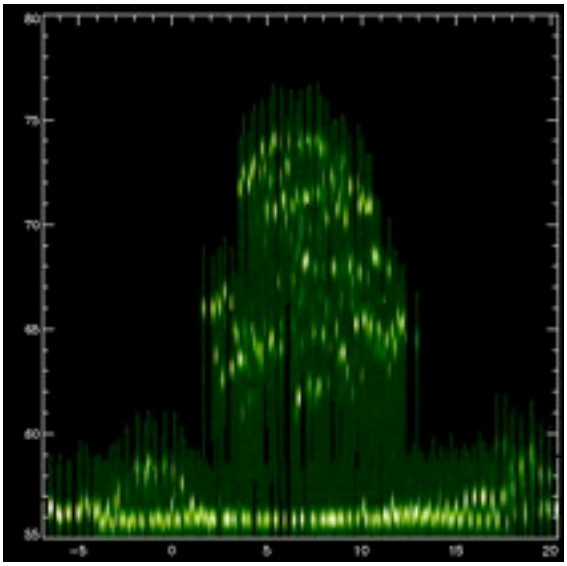
GeocodeWF transforms the raw data to an easy-to-use geo-referenced and system-independent waveform data format that the user can use to exploit the full wealth of information about the surface that is only available with full-waveform lidar data.

Applications include forestry (accurate single tree location, sub-canopy surveying, and species classification), precision agriculture, surface cover and usage mapping, drainage and water flow modelling, and many others.

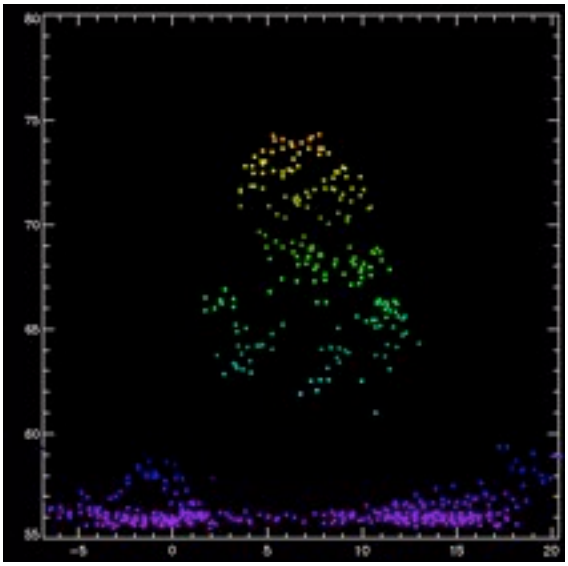
Orthophoto



Color-coded Elevation



Geocoded Waveform (waveform amplitude displayed by brightness)



Point Cloud