

## TerraScan New Features

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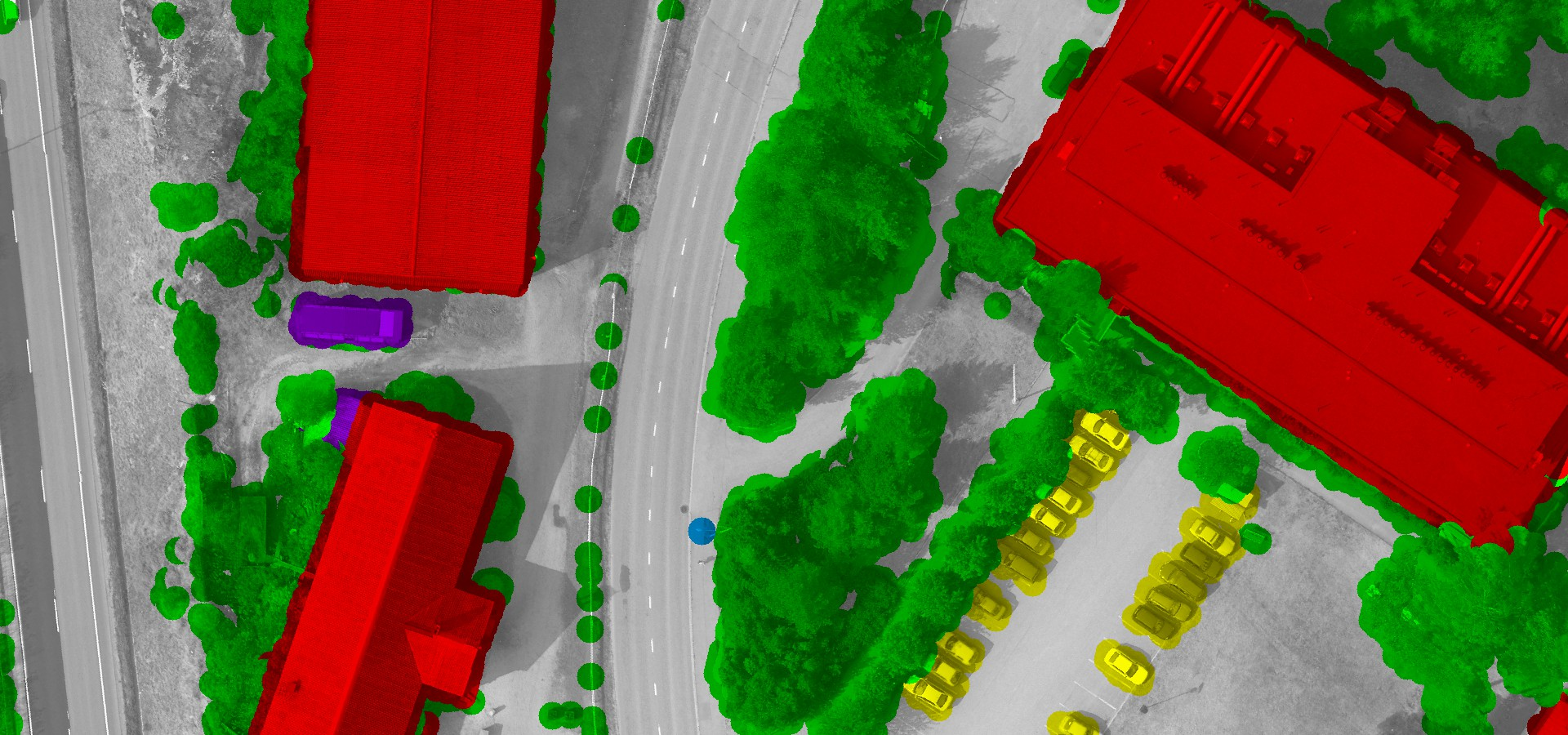


Color by 'Image color'





# Color by 'Class + image'



# 'Image color' & 'Class + image' Coloring Modes

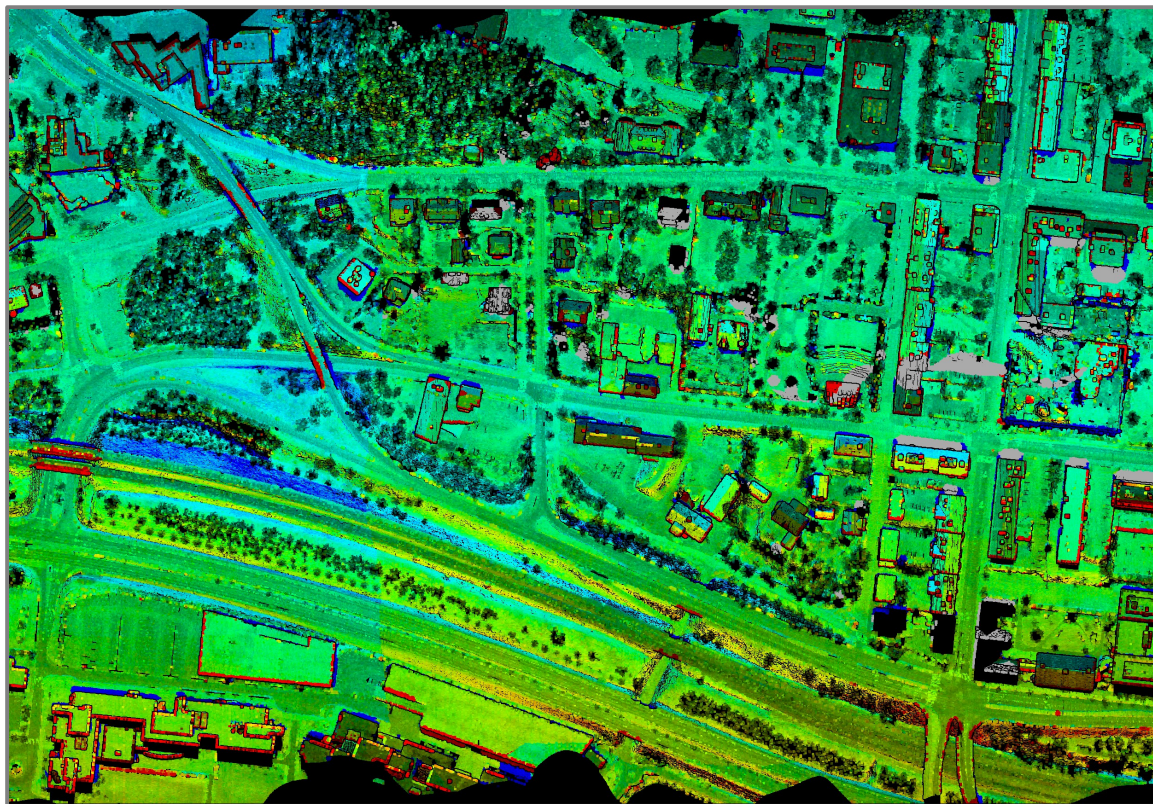


- Preparation steps:
  - Open mission and load image list in TerraPhoto
  - Extract color from images storing image number (points get color and image number)
  - (Optional) Compute normal vectors
- TerraScan will draw points into view as 3D discs (=ellipses)
- TerraPhoto colors each pixel from images
- TerraPhoto keeps raw images in cache
- **Image Cache / Max size in Photo Settings / Memory usage** needs to be big enough
- First screen update is slow as software needs to read raw images



# 'Distance + intensity' Coloring Mode

- Distance gives color, intensity gives brightness



# Reflectance & Amplitude Support in Coloring Modes



- **Class+intensity, Distance+intensity, Line+intensity, Time+intensity, Group+intensity, Normal+intensity** and **Color+intensity** coloring modes can use reflectance or amplitude if no intensity available
- Attribute use order: intensity, reflectance, amplitude, color



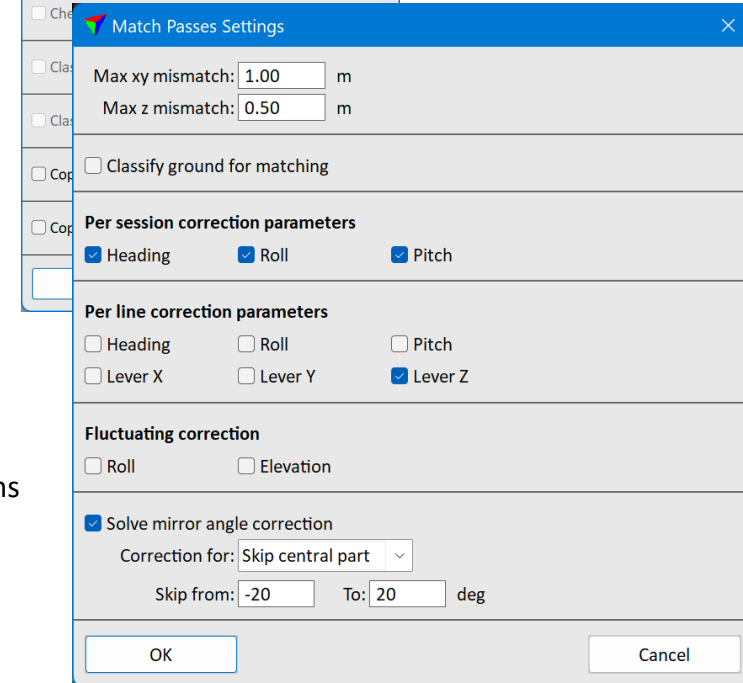
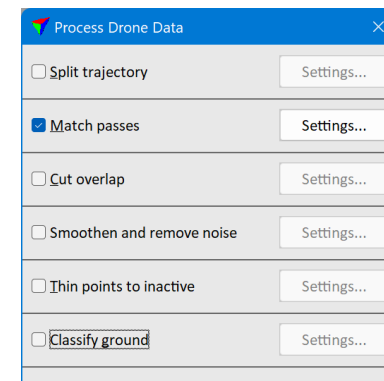
# Various Improvements



- Distance coloring scheme has setting for how to color points with no distance value
- **Classify by Echo** can classify points which have zero as echo number or as echo count
- Better bounding circle routine in **Draw Polygons**
- Scan angle field unit setting in user point file format definition (unit can be degree or integer units as defined in LAS 1.4 file format)
- **Apply / Shift** menu command in control report copies shift transformation to the clipboard so it can be pasted into TerraScan or TerraPhoto transformation table
- **Clear distance** available as macro action
- **Compute normal vectors** has **Inside fence only** option
- Multiple source classes in **Classify / By absolute elevation**
- **Extract color from images** has an option to store image number only and not modify color of points

# Match Passes in Process Drone Data

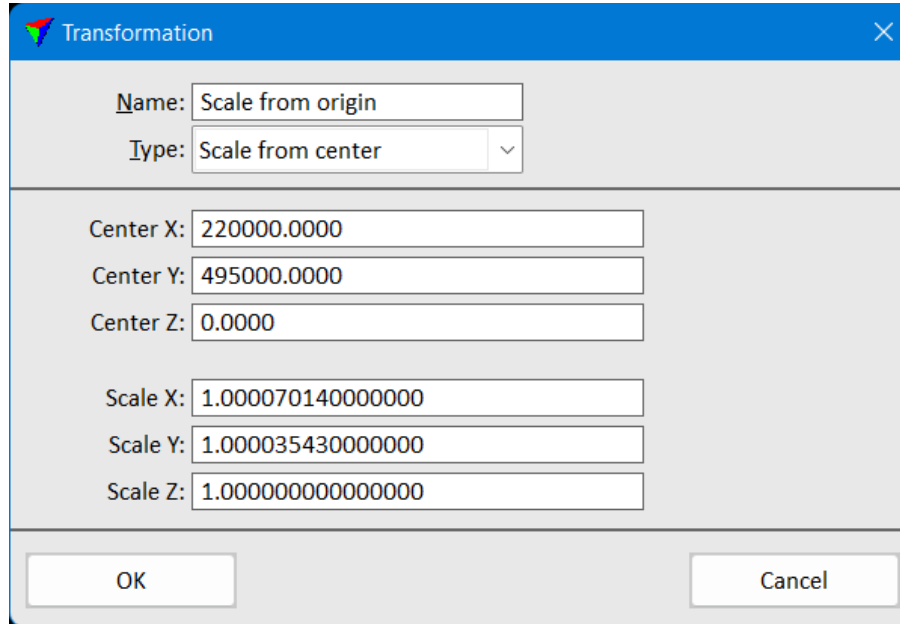
- Step in TerraScan **Process Drone Data** tool
- Runs automatic matching of flight passes to each other
- Requires TerraMatch or TerraMatch UAV license to run
- Collects tie line observations for three different correction levels:
  - Heading + roll + pitch per flight session (=trajectory group)
  - Heading + roll + pitch + x + y + z per line
  - Fluctuating roll + z
- Solves and applies **Mirror Angle** correction curve
- Saves matching report, tie line and correction files:
  - matching\_report.txt
  - tielines\_start.til, tielines\_per\_session\_done.til, tielines\_per\_line\_done.til, tielines\_fluctuating\_done.til
  - 01\_per\_session\_hrp.tms, 02\_per\_line\_z.tms, 03\_fluct\_z.tms, 04\_mirror\_angle.tms





# New Transformation Type

- **Scale from center** applies a scale factor to points relative to a given center point



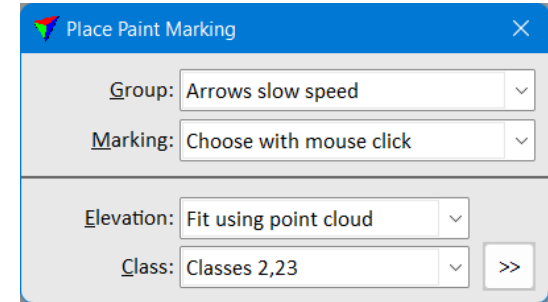
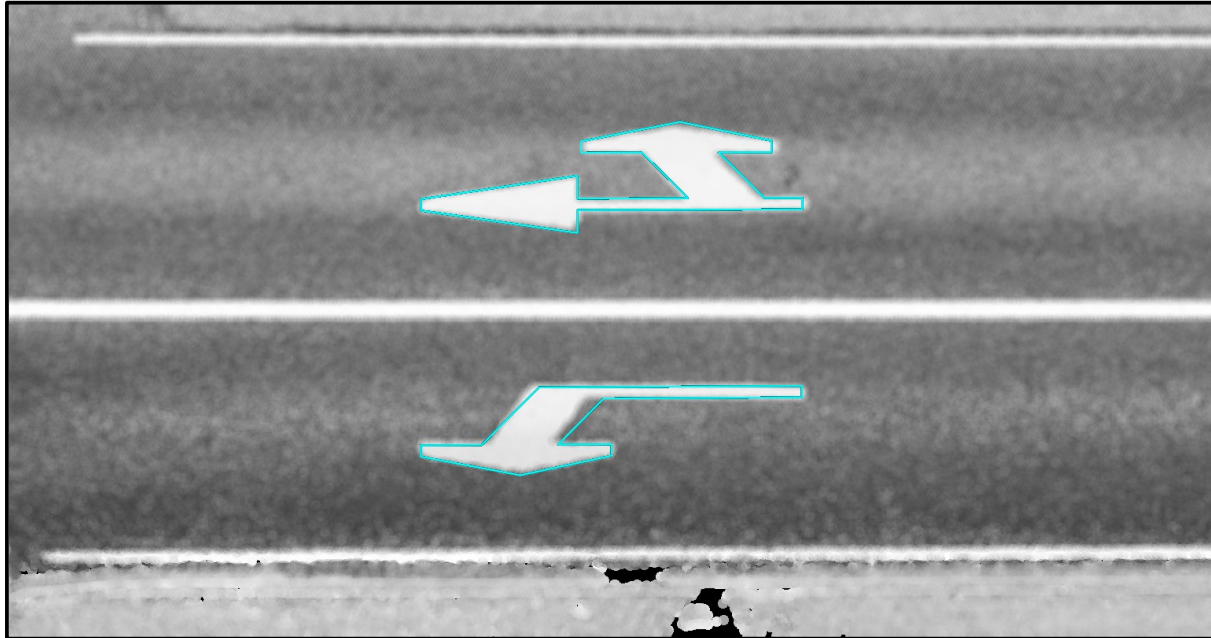
The screenshot shows a software dialog box titled "Transformation" with a close button (X) in the top right corner. The dialog contains several input fields for configuring a transformation:

- Name:** A text input field containing "Scale from origin".
- Type:** A dropdown menu currently set to "Scale from center".
- Center X:** A text input field containing "220000.0000".
- Center Y:** A text input field containing "495000.0000".
- Center Z:** A text input field containing "0.0000".
- Scale X:** A text input field containing "1.0000701400000000".
- Scale Y:** A text input field containing "1.0000354300000000".
- Scale Z:** A text input field containing "1.0000000000000000".

At the bottom of the dialog, there are two buttons: "OK" on the left and "Cancel" on the right.

# Place Paint Marking

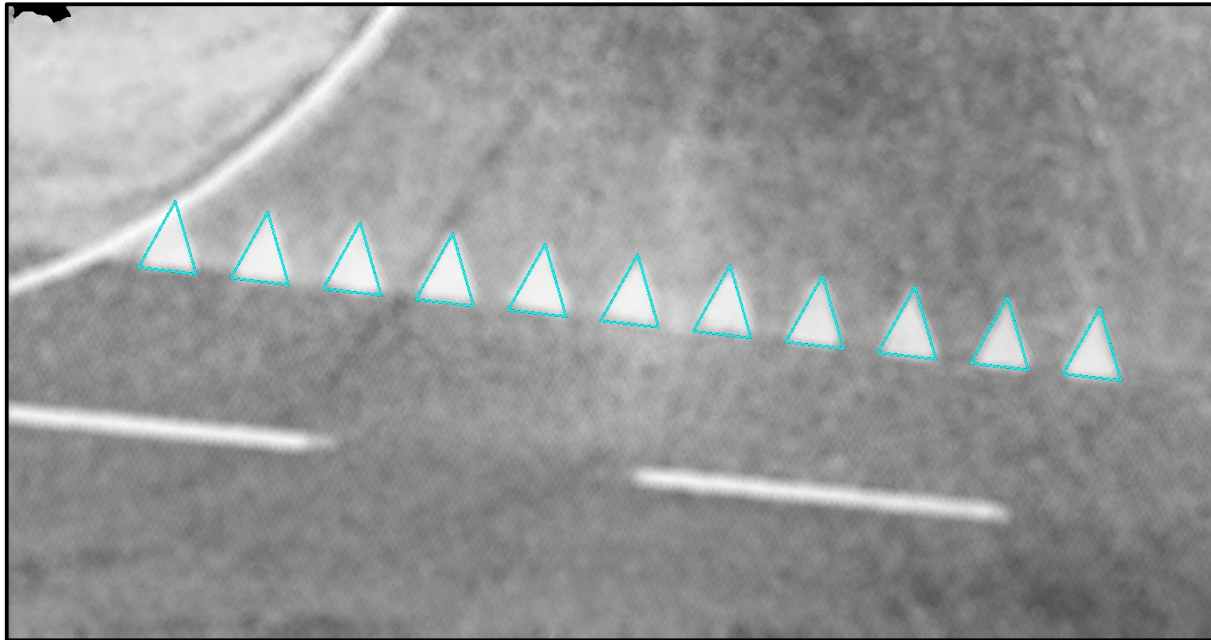
- Automatic recognition of paint marking using point cloud intensity or orthophoto





# Place Paint Symbol Row

- Places a row of triangles or rectangles manually
- Can use point cloud to get elevation for vertices



Place Paint Symbol Row

Symbol: Triangle

Width: 0.500 m

Height: 0.600 m

Spacing: 0.300 m

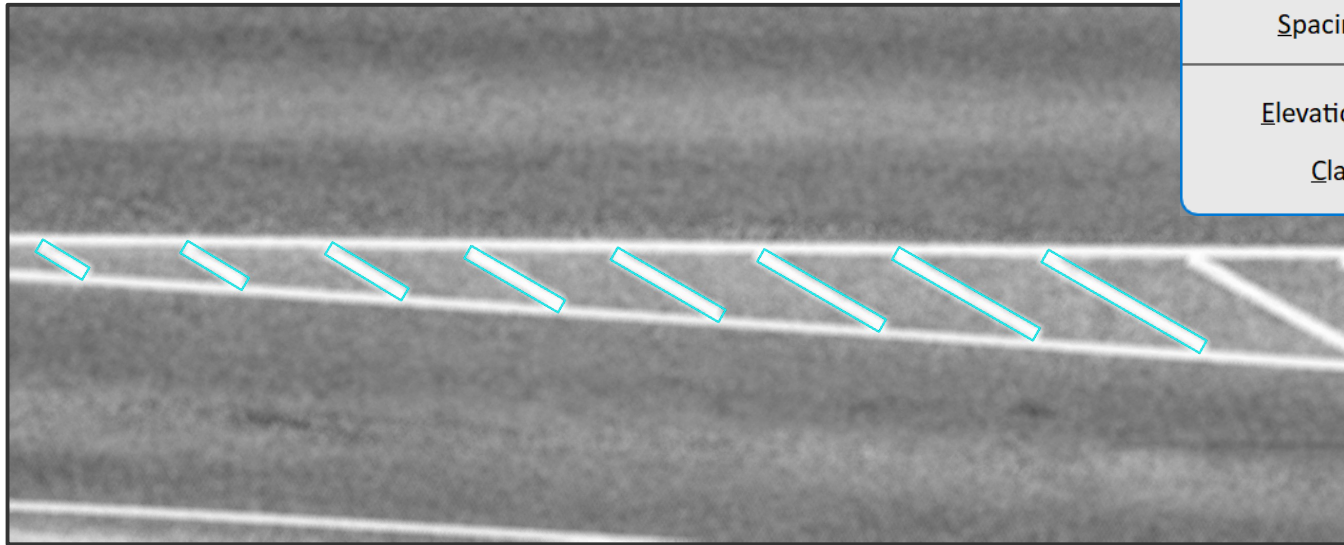
Elevation: Fit using point cloud


Class: Classes 2-3

>>

# Place Paint Stripes

- Places a row of paint line polygons
- Can use point cloud to get elevation for vertices



 Place Paint Stripes ✕

Width:  m

Spacing:  m

Elevation:  ▾

Class:  ▾



# Compute Distance & Paint Thickness

- Computes value for points inside polygons on given levels
- Fits a plane or a second degree surface to points outside polygon
- Points get height from fitted surface as distance value

Compute Distance

Class: Classes 2,23 >>

Distance: Paint thickness >>

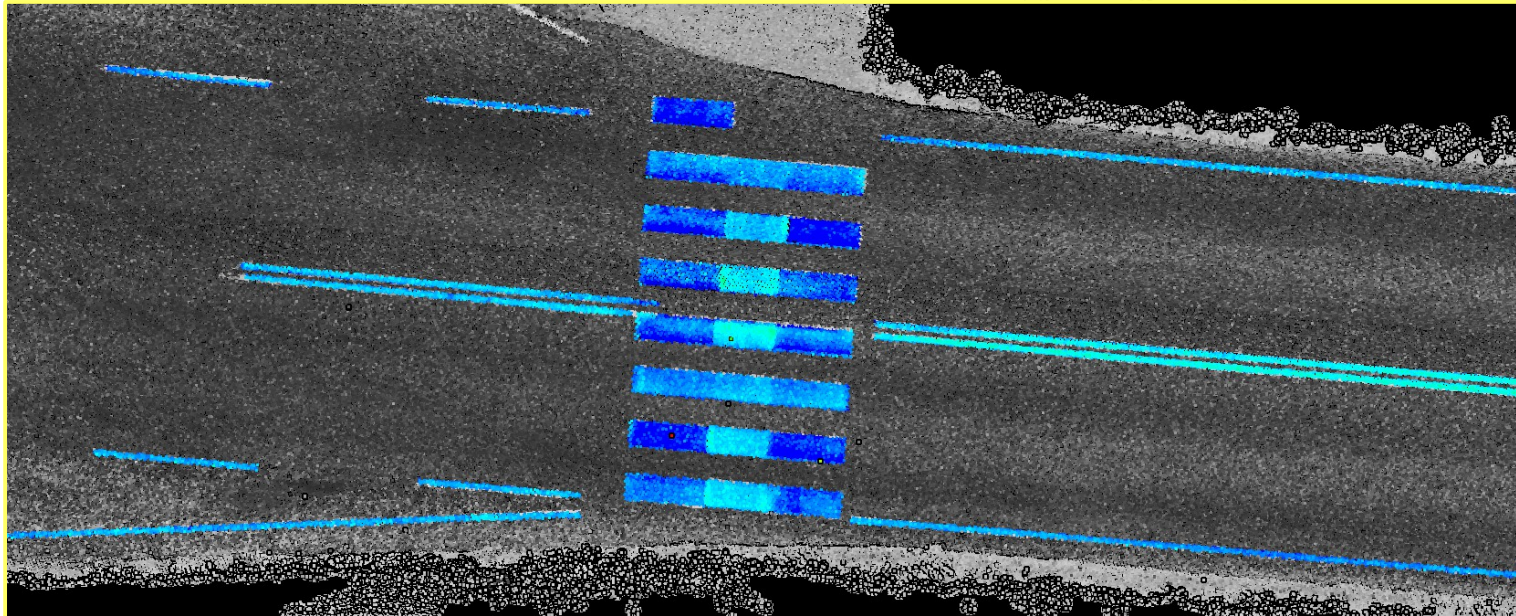
Polygon levels: 10-15 >>

Surface: Planar >>

Polygon margin: 0.010 m

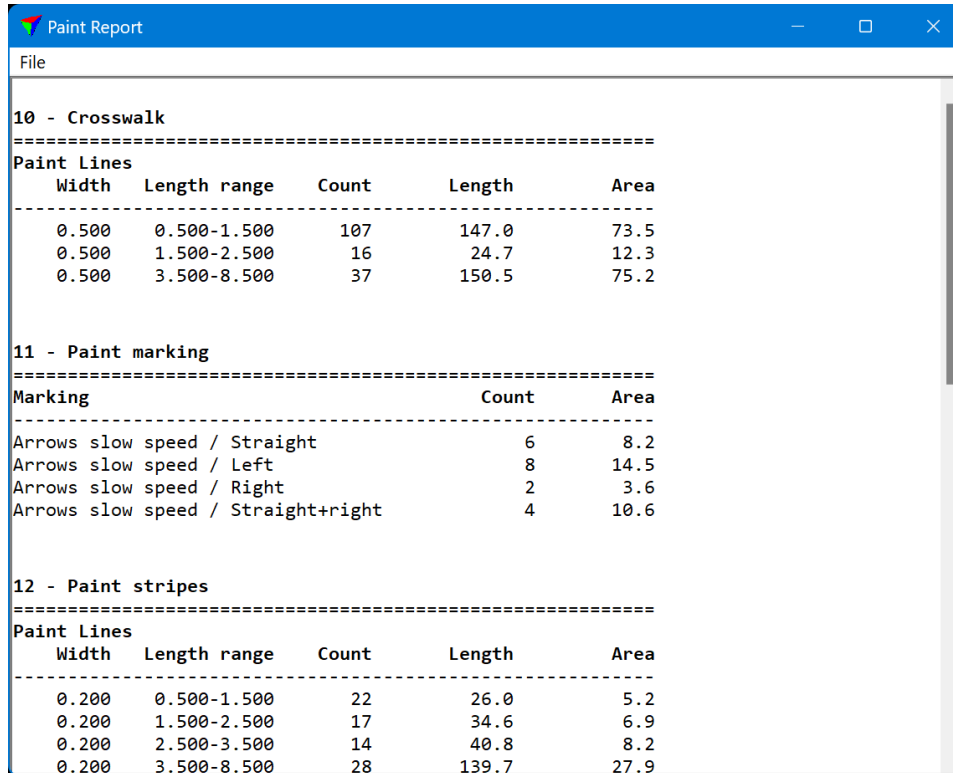
Max distance: 0.50 m

OK Cancel



# Output Paint Report

- Writes a summary report on selected paint marking and paint line polygons



**10 - Crosswalk**

=====  
**Paint Lines**

Width	Length range	Count	Length	Area
0.500	0.500-1.500	107	147.0	73.5
0.500	1.500-2.500	16	24.7	12.3
0.500	3.500-8.500	37	150.5	75.2

**11 - Paint marking**

=====  
**Marking**

	Count	Area
Arrows slow speed / Straight	6	8.2
Arrows slow speed / Left	8	14.5
Arrows slow speed / Right	2	3.6
Arrows slow speed / Straight+right	4	10.6

**12 - Paint stripes**

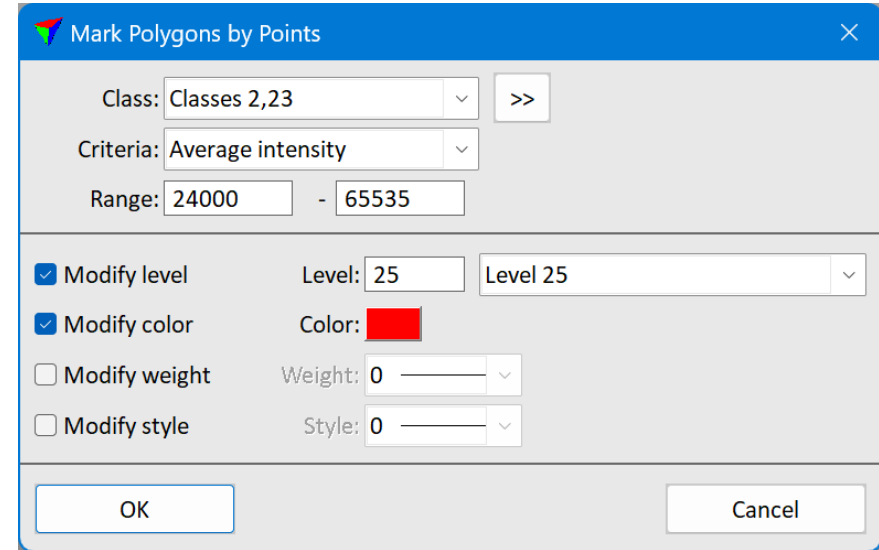
=====  
**Paint Lines**

Width	Length range	Count	Length	Area
0.200	0.500-1.500	22	26.0	5.2
0.200	1.500-2.500	17	34.6	6.9
0.200	2.500-3.500	14	40.8	8.2
0.200	3.500-8.500	28	139.7	27.9



# Mark Polygons by Points

- Marks selected polygons by statistics from points inside each polygon
  - Presence of points (=points in specific class inside polygon)
  - Point density
  - Average amplitude
  - Average brightness (=color brightness)
  - Average intensity
  - Average reflectance
  - Smallest distance
  - Average distance
  - Biggest distance
- This can mark paint polygons by:
  - Paint brightness (Average intensity)
  - Paint thickness (Average distance)



The screenshot shows a software dialog box titled "Mark Polygons by Points". It contains several configuration options:

- Class:** A dropdown menu set to "Classes 2,23" with a right-pointing arrow button.
- Criteria:** A dropdown menu set to "Average intensity".
- Range:** Two input fields containing "24000" and "65535" separated by a minus sign.
- Modify level:** A checked checkbox, a "Level:" input field with "25", and a dropdown menu showing "Level 25".
- Modify color:** A checked checkbox, a "Color:" label, and a red color swatch.
- Modify weight:** An unchecked checkbox, a "Weight:" label, and a dropdown menu set to "0".
- Modify style:** An unchecked checkbox, a "Style:" label, and a dropdown menu set to "0".

At the bottom, there are "OK" and "Cancel" buttons.

# Geoid Model Support

- Support for Latvian geoid model LV14
- Support for Brazilian geoid model HGEOHNOR2020
- Support for Korean geoid model KNGEOID18 (geoid file not part of setup package)
- Support for Canadian geoid model CGVD2013
- Support for German geoid model GCG2016



# Manage Trajectories Improvements

- **Convert time** shows conversion result for first time stamp
- **View / Sort** can sort trajectories by duration
- Support for Inertial Explorer trajectory text file format

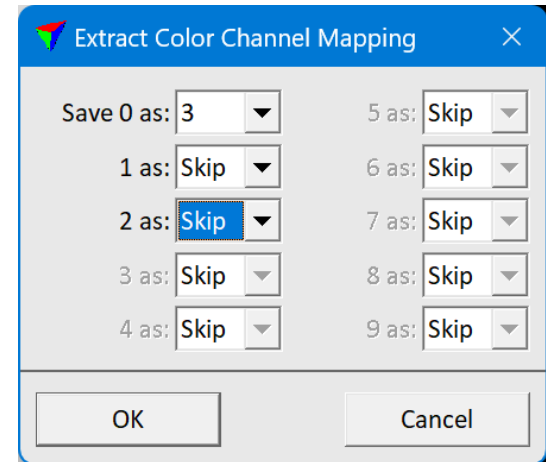
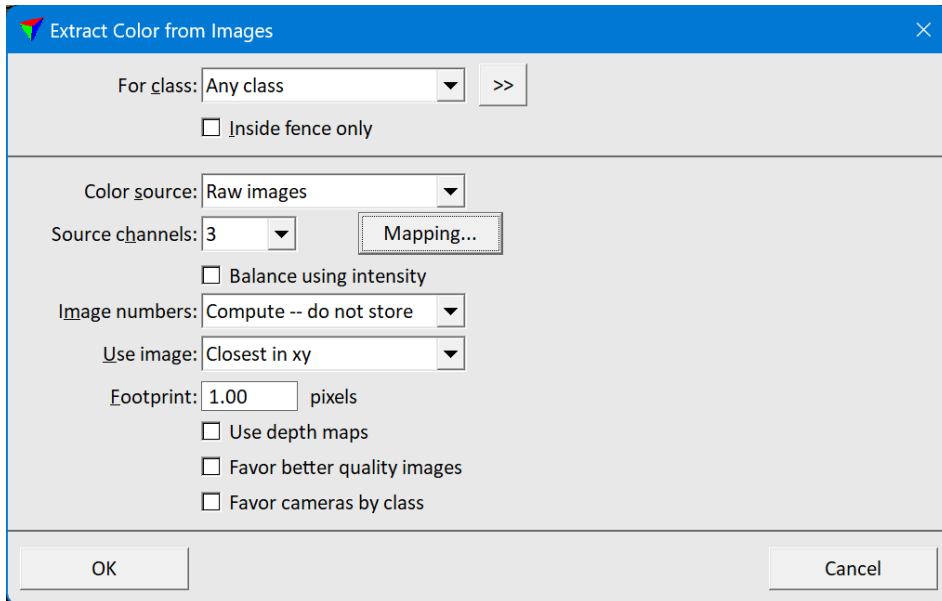




# Extract Color & Channel Mapping

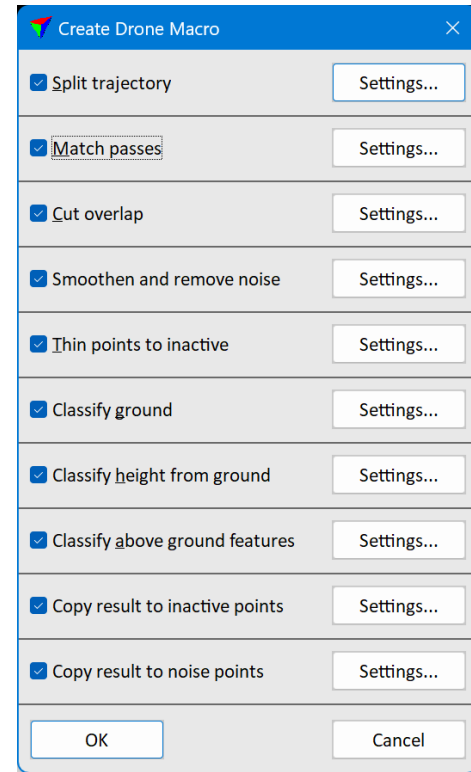
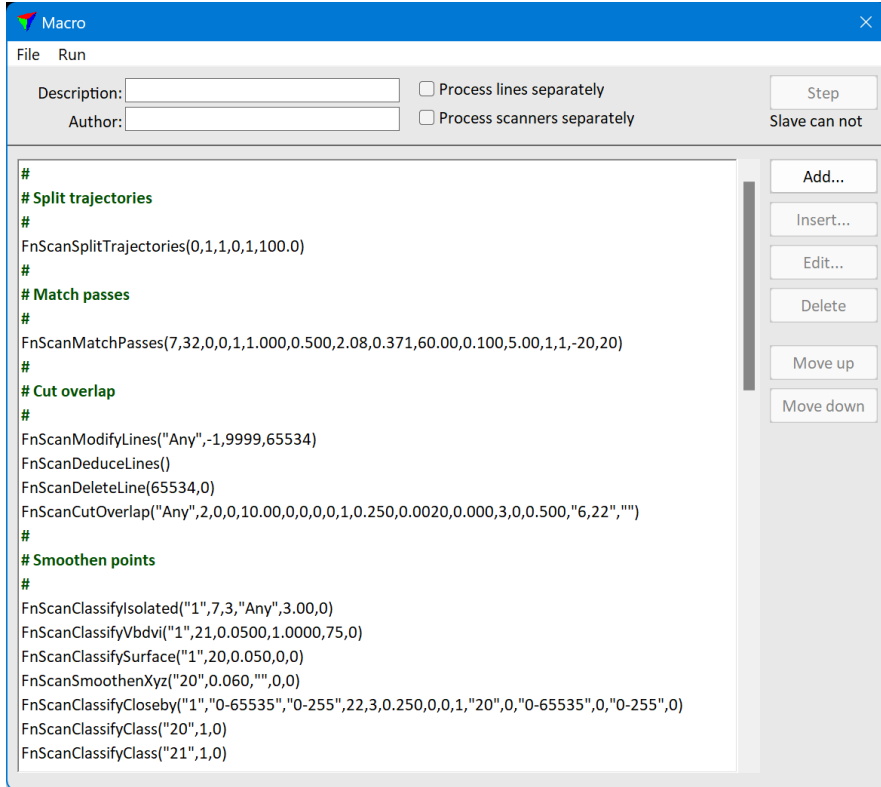


- Channel mapping makes it possible to extract RGB channels from one set of images and NIR channel from another set of images
  - Get channels 0, 1 and 2 from RGB
  - Get channel 3 from NIR



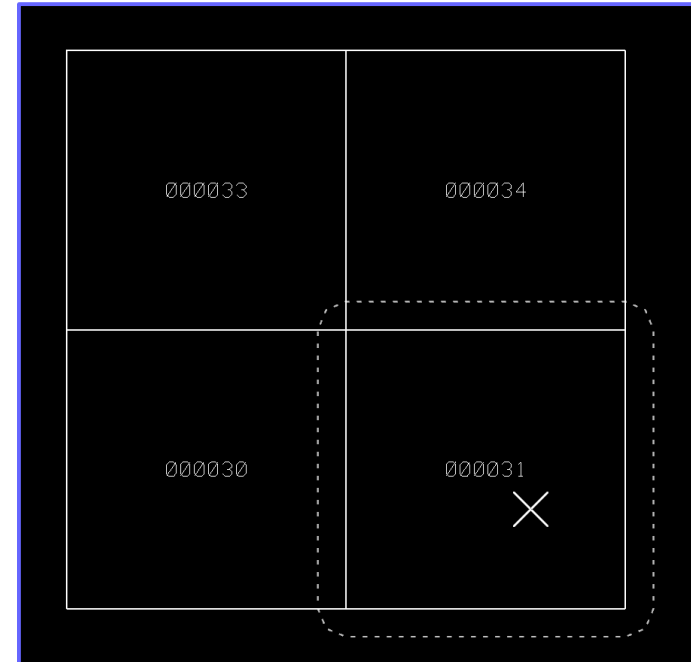
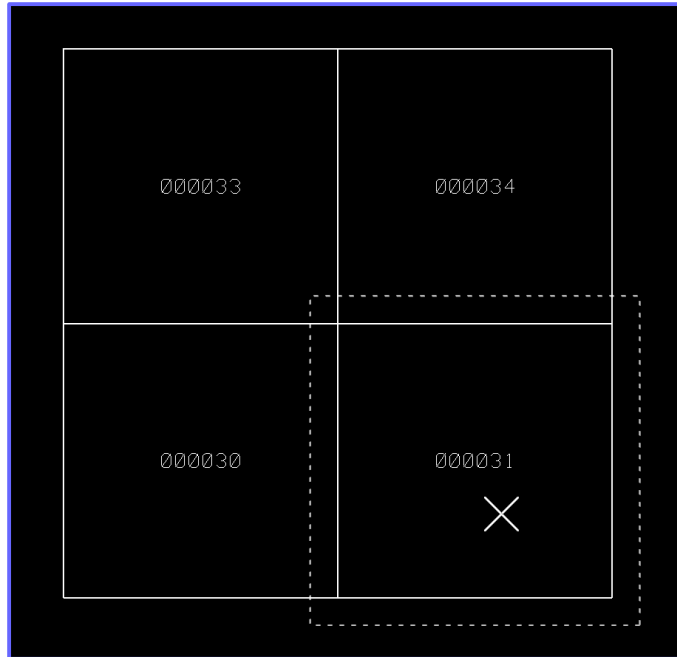
# Wizard / Create Drone Macro

- Creates a macro for selected drone processing Wizard steps
- Makes it easier to modify processing steps



# Neighbour Area Choice in Define Project

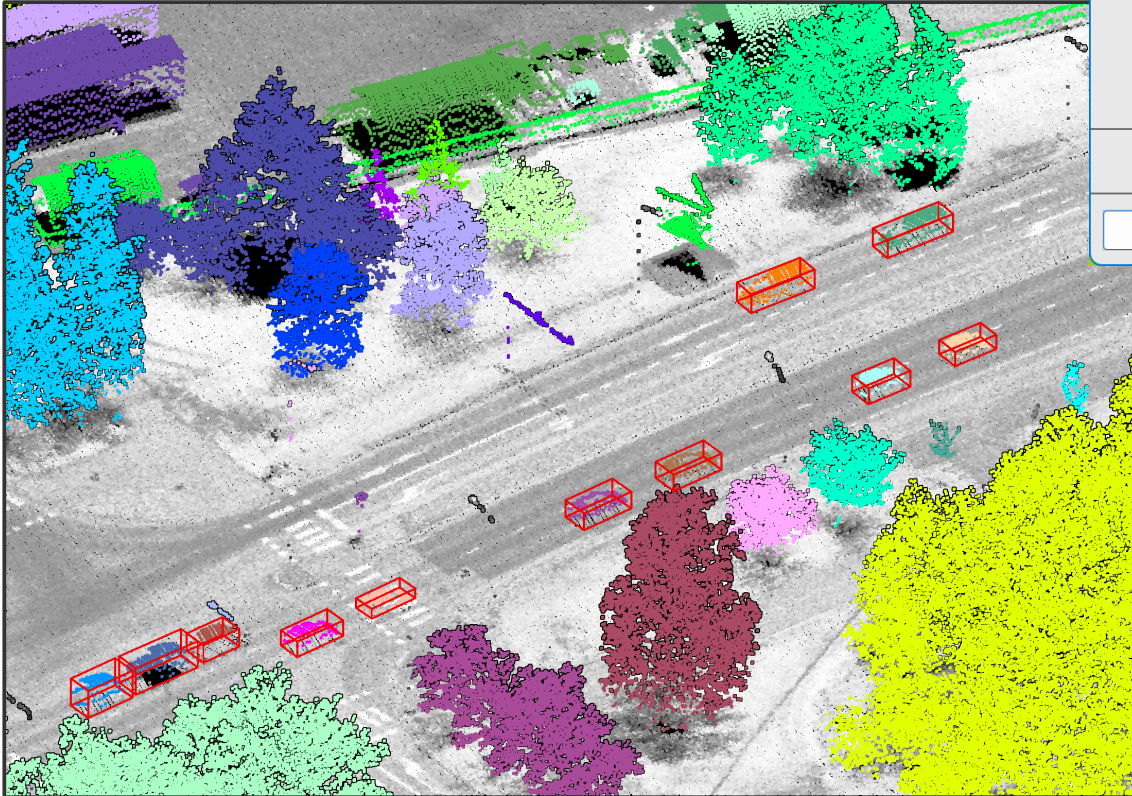
- **Neighbour area** setting in project information defines the shape of area for neighbouring points:
  - **Sharp corners** will use sharp corner polygon
  - **Rounded corners** will use rounded polygon





# Draw Polygons and Bounding Box

- **Draw Polygons** has **Bounding boxes** option in **Draw as** field
- Draws 3D bounding box as cell element with 6 polygons



**Draw Polygons** [X]

Class: 17 - Car [v] >>

Separate groups  
 Inside fence only

Draw as: Bounding boxes [v]

Gap distance: 1.00 m  
Min size: 0.100 m<sup>2</sup>

Label: No label [v]

OK Cancel

# Longitude/Latitude and Geocentric Output



- **Save As** menu command from main window can save **WGS84 lon/lat** or **WGS84 geocentric**
  - Available when active projection system is specified
- **Output points** macro step has support for **WGS84 lon/lat** and **WGS** geocentric output

A screenshot of a software dialog box titled "Save points". The dialog has a blue header bar with a close button (X) on the right. The main area is light gray and contains several settings:

- "Save class:" with a dropdown menu set to "Any class" and a ">>" button to its right.
- "Points:" with a dropdown menu set to "All points".
- "Line:" with a dropdown menu set to "All flightlines".
- "Format:" with a dropdown menu set to "LAS 1.2" and an "Attributes..." button to its right.
- "Transform:" with a dropdown menu set to "WGS84 lon & lat".
- An unchecked checkbox labeled "Inside fence only".

At the bottom of the dialog, there are two buttons: "OK" on the left and "Cancel" on the right.

# New Drone Project and Process Drone Data

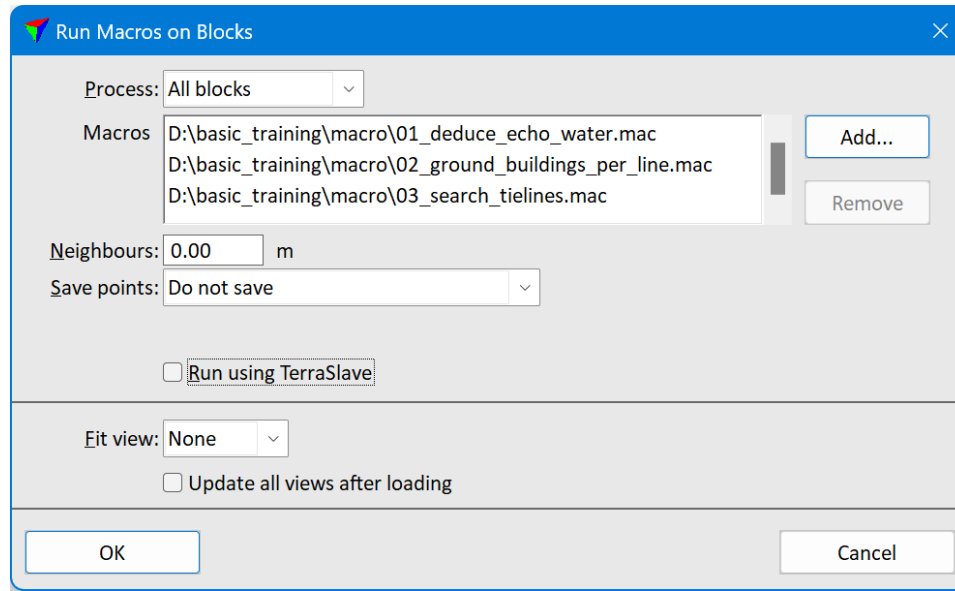


- Support for new systems:
  - YellowScan Explorer
  - YellowScan Mapper
  - YellowScan Mapper+
  - YellowScan Surveyor Ultra
  - YellowScan Voyager
  - YellowScan Vx15
  - YellowScan Vx20
  - AlphaAir 450



# Run Multiple Macros on Project

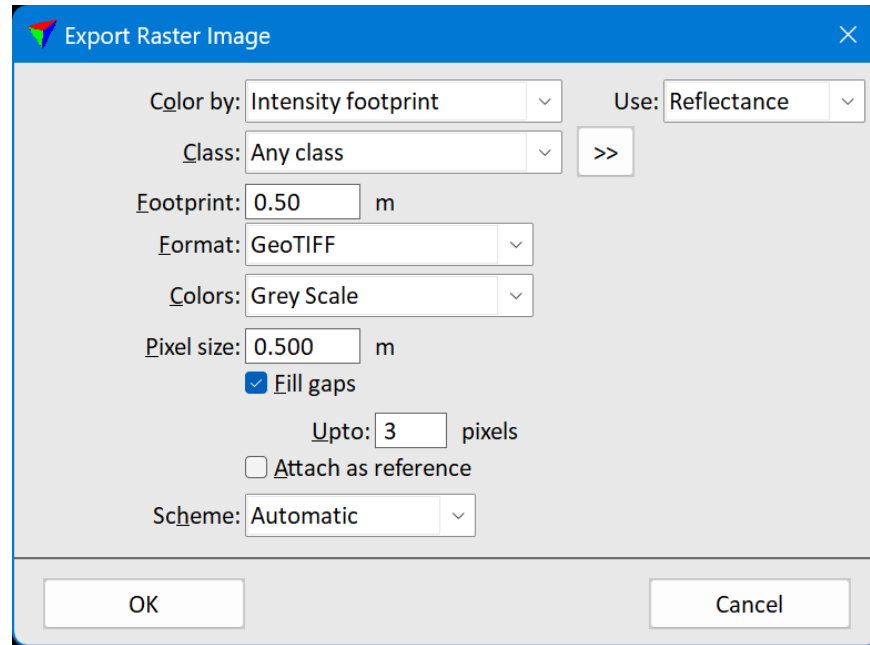
- You can select multiple macros to run on a project
- Needed to automate matching:
  - One classifies ground (has **Process flightlines separately** on)
  - Another macro searches tie lines
- No need to save points – need to save tie lines only



# Raster Image Output Improvements

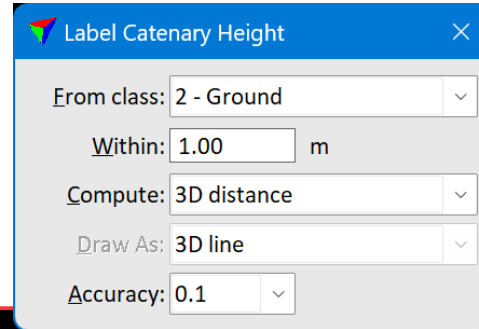


- **Output / Export raster image** menu command and **Tools / Export raster images** from project window can produce rasters with normal coloring
- **Output / Export raster image** menu command and **Tools / Export raster images** from project window can produce rasters with reflectance or amplitude based coloring



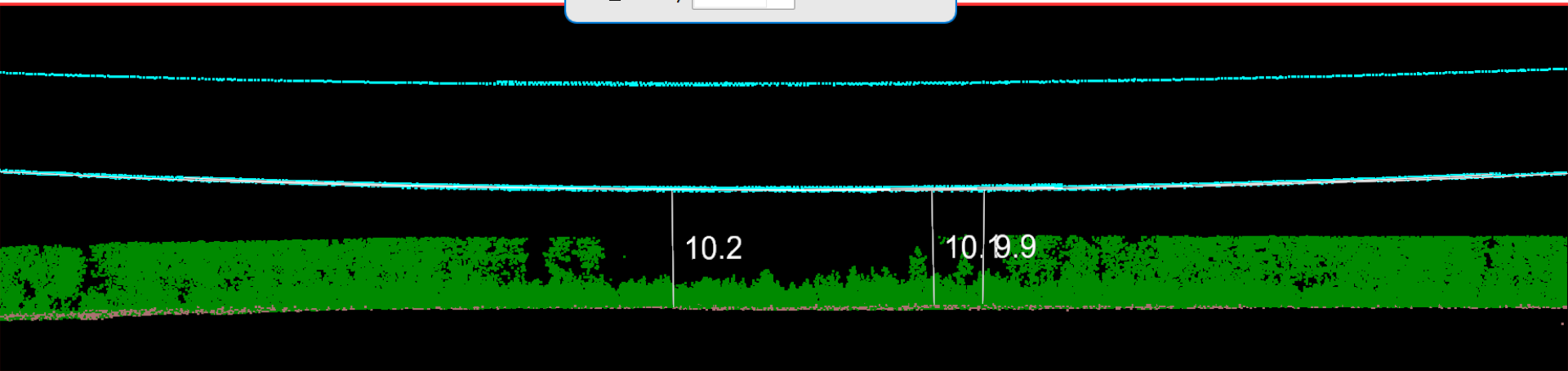
# Label Catenary Height Improvements

- Can label multiple wires if you select wires before you start the tool
- Option to control if reported distance should be 3D distance or vertical difference



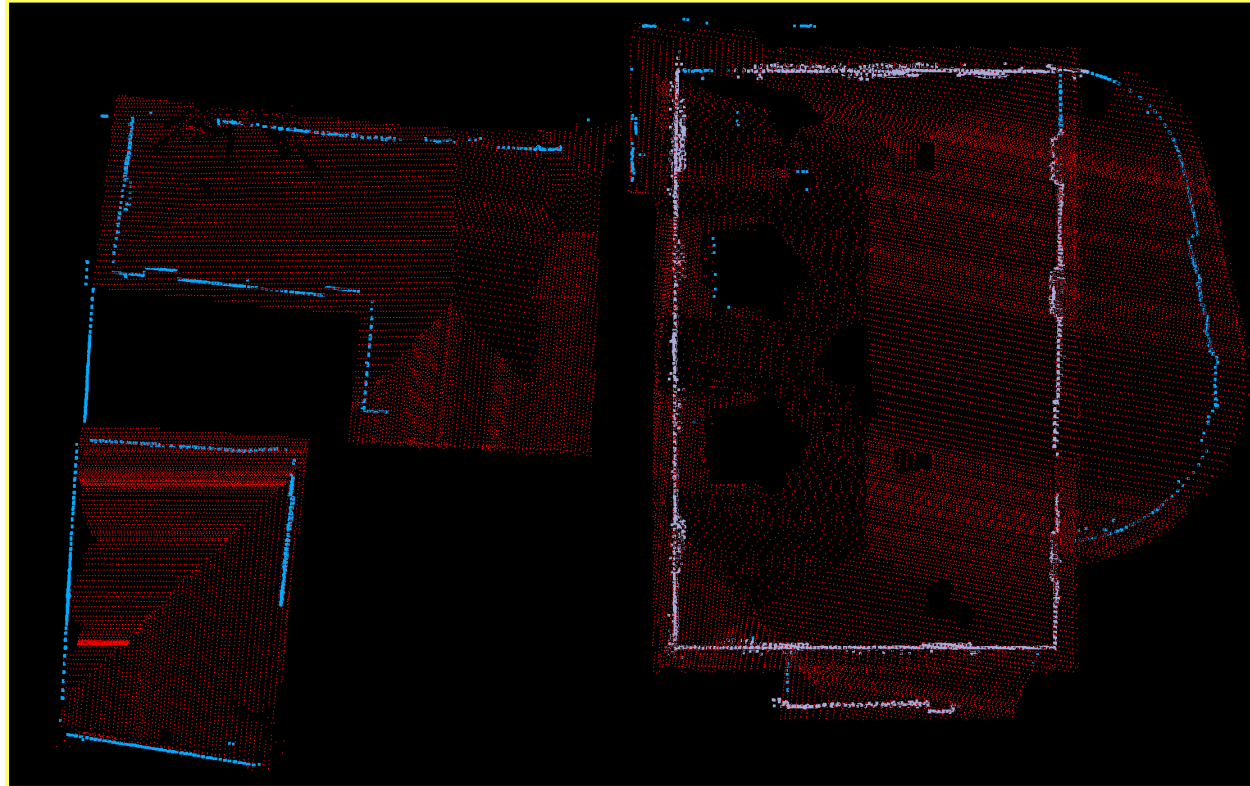
The screenshot shows a dialog box titled "Label Catenary Height" with a close button (X) in the top right corner. The dialog contains the following settings:

- From class: 2 - Ground
- Within: 1.00 m
- Compute: 3D distance
- Draw As: 3D line
- Accuracy: 0.1



# Tools for Vectorizing Walls

- New tools for creating building footprint polygons or polygons+lines for wall locations
- Source point cloud should have some hits walls:
  - UAV laser data
  - UAV photogrammetric
  - Airborne laser data
  - Mobile laser data

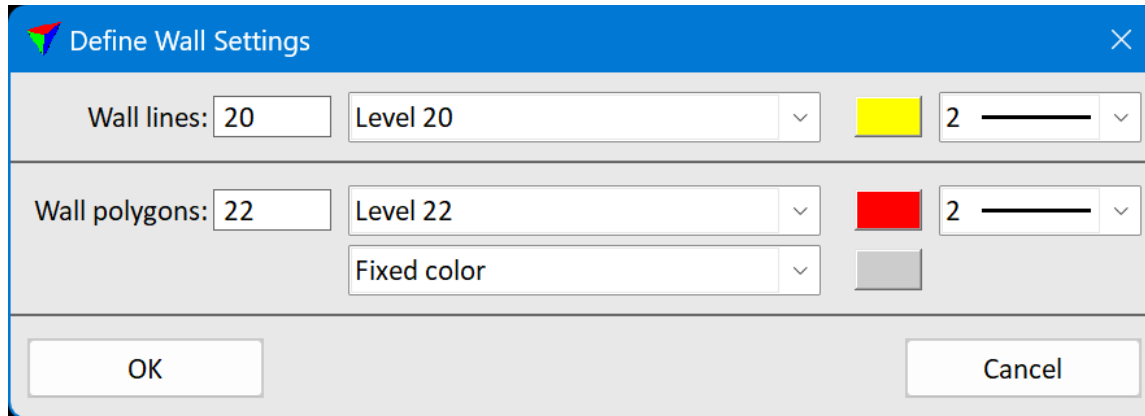




# Define Wall Settings



- Define active settings for wall vectorization tools



The screenshot shows a dialog box titled "Define Wall Settings" with a blue header bar. The dialog is divided into two main sections for "Wall lines" and "Wall polygons".

**Wall lines section:**

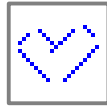
- Input field: 20
- Dropdown menu: Level 20
- Color swatch: Yellow
- Line thickness dropdown: 2

**Wall polygons section:**

- Input field: 22
- Dropdown menu: Level 22
- Color swatch: Red
- Line thickness dropdown: 2
- Dropdown menu: Fixed color
- Color swatch: Grey

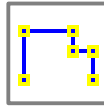
At the bottom of the dialog, there are two buttons: "OK" on the left and "Cancel" on the right.

# Vectorize Wall Lines



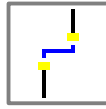
- Create line work from wall hits – whole data set or inside fence

# Place Wall Line



- Place wall line / line string manually

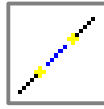
# Place Wall Corner



- Connect wall lines with perpendicular line segment

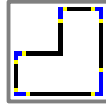


# Connect Wall Lines



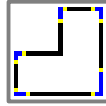
- Connect wall lines with a connecting line or by extending lines to intersection point

# Build Wall Polygon



- Create closed polygon from lines
- You can select lines/line strings/polygons before you start the tool
- Or you can manually pick lines/line strings to connect into a polygon

# Build Wall Polygon



- Create closed polygon from lines
- You can select lines/line strings/polygons before you start the tool
- Or you can manually pick lines/line strings to connect into a polygon

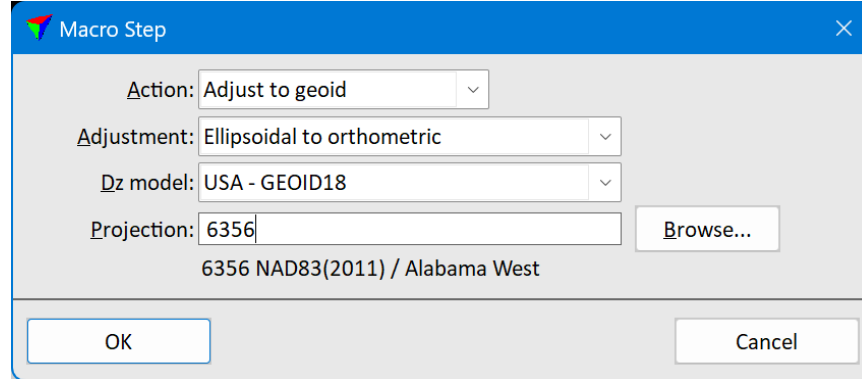
# Delete Wall Lines



- Deletes line work from given level
- Use this when you have built a polygon from line work

# 'Adjust to geoid' as Macro Step

- You can run geoid correction as one of the steps in a macro
- Geoid model can be:
  - Text file (easting northing dz)
  - One of standard geoid models which come with software setup



The screenshot shows a 'Macro Step' dialog box with the following settings:

- Action: Adjust to geoid
- Adjustment: Ellipsoidal to orthometric
- Dz model: USA - GEOID18
- Projection: 6356 (with a 'Browse...' button next to it)
- 6356 NAD83(2011) / Alabama West

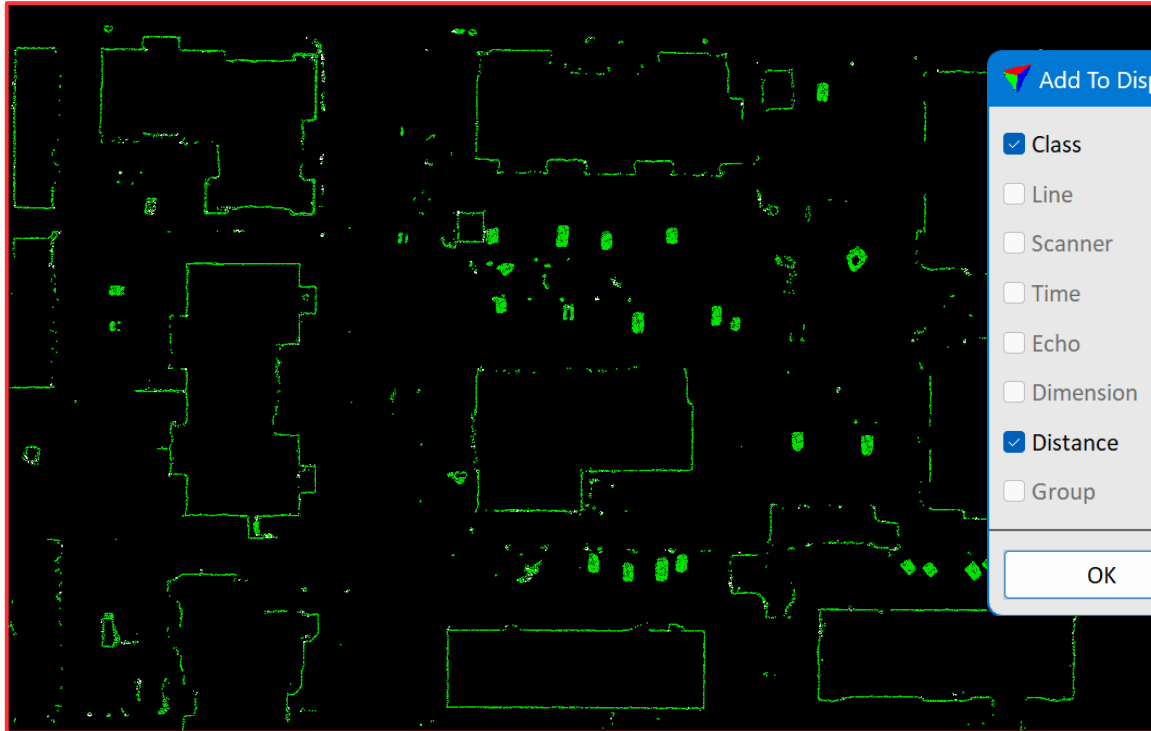
Buttons: OK, Cancel



# Add to Displayset by Criteria



- Add points to displayset by selected criteria
- For example: add points in any class at height 1.000 – 1.500 m above ground



**Add To Displayset By Criteria**

Class  >>

Line

Scanner

Time

Echo

Dimension

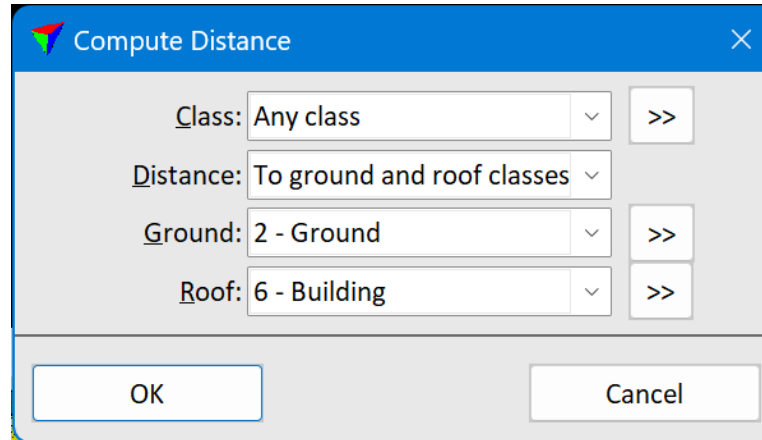
Distance  -  m

Group

OK Cancel

# Compute Distance & To ground and roof

- Compute distance can compute height from ground or roof class
- Needed in data sets with roof top parking

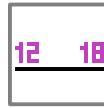


The screenshot shows a dialog box titled "Compute Distance" with a close button (X) in the top right corner. The dialog contains four rows of configuration options, each with a dropdown menu and a right-pointing arrow button (>>) to its right:

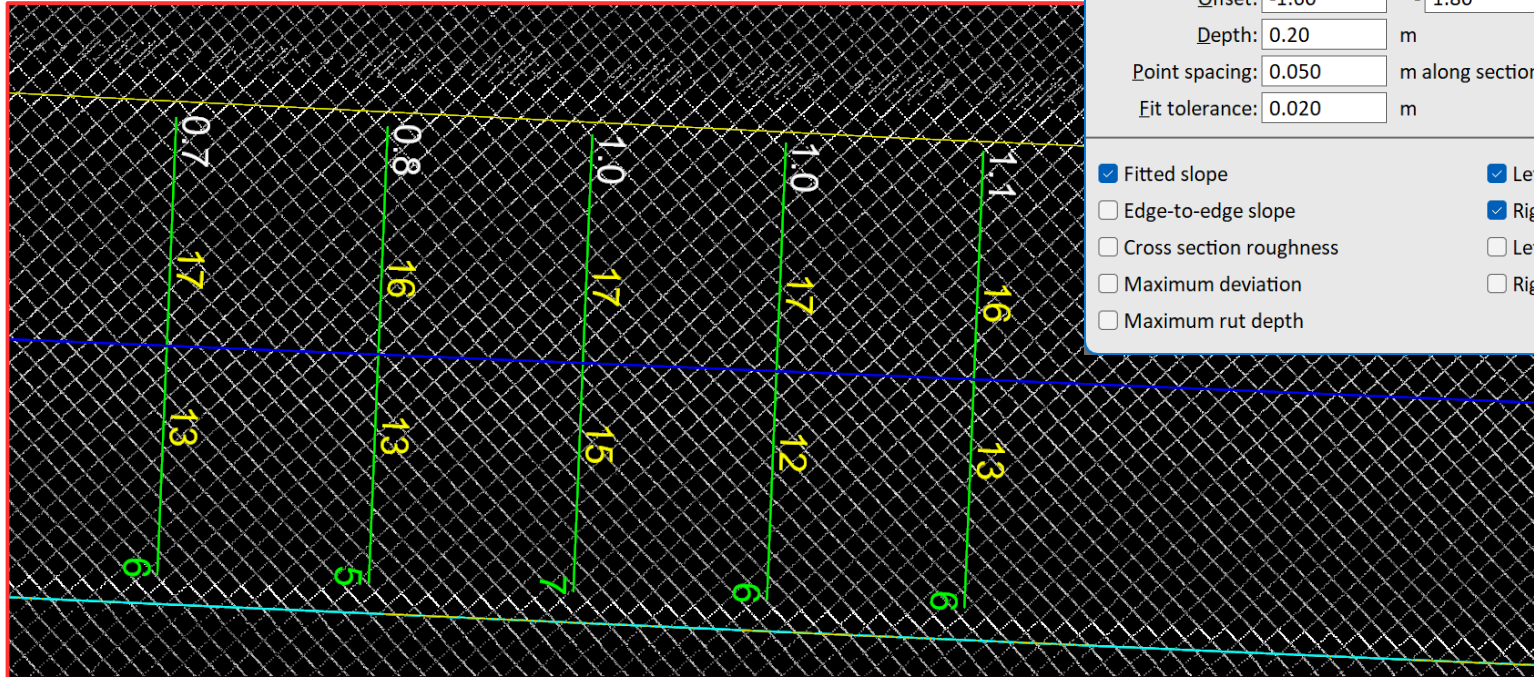
- Class:** Any class
- Distance:** To ground and roof classes
- Ground:** 2 - Ground
- Roof:** 6 - Building

At the bottom of the dialog, there are two buttons: "OK" on the left and "Cancel" on the right.

# Label Section Parameters



- Tool for labeling one location at a time with road section parameters



**Label Section Parameters**

Class:  >>

Offset:  -  m

Depth:  m

Point spacing:  m along section

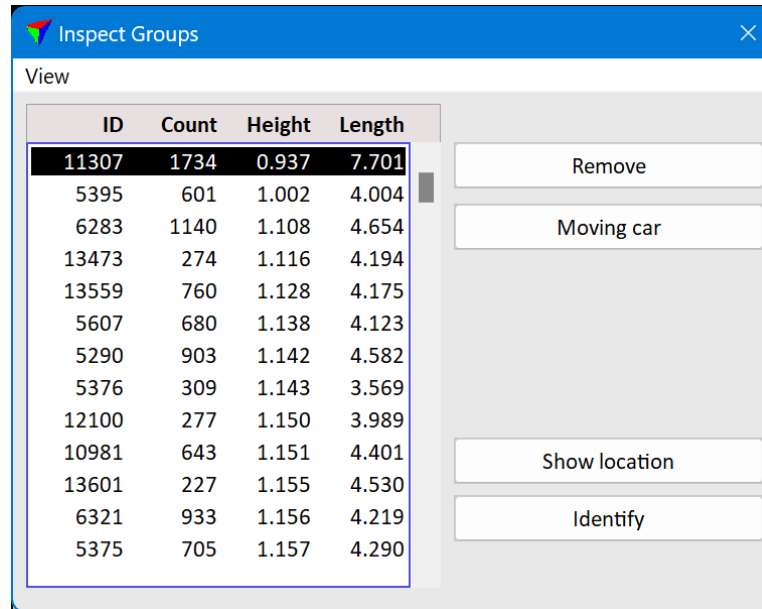
Fit tolerance:  m

Fitted slope  
 Edge-to-edge slope  
 Cross section roughness  
 Maximum deviation  
 Maximum rut depth

Left rut depth  
 Right rut depth  
 Left rut water depth  
 Right rut water depth

# Inspect Groups Improvements

- Can display class list, height, width, length, radius, minimum distance or maximum distance value of each group
- Can sort groups by parameters listed above



The screenshot shows a software window titled "Inspect Groups" with a close button in the top right corner. Below the title bar, the word "View" is displayed. The main content area contains a table with four columns: "ID", "Count", "Height", and "Length". The first row of the table is highlighted in black. To the right of the table, there are several buttons: "Remove", "Moving car", "Show location", and "Identify".

ID	Count	Height	Length
11307	1734	0.937	7.701
5395	601	1.002	4.004
6283	1140	1.108	4.654
13473	274	1.116	4.194
13559	760	1.128	4.175
5607	680	1.138	4.123
5290	903	1.142	4.582
5376	309	1.143	3.569
12100	277	1.150	3.989
10981	643	1.151	4.401
13601	227	1.155	4.530
6321	933	1.156	4.219
5375	705	1.157	4.290

# Color by 'Depth'

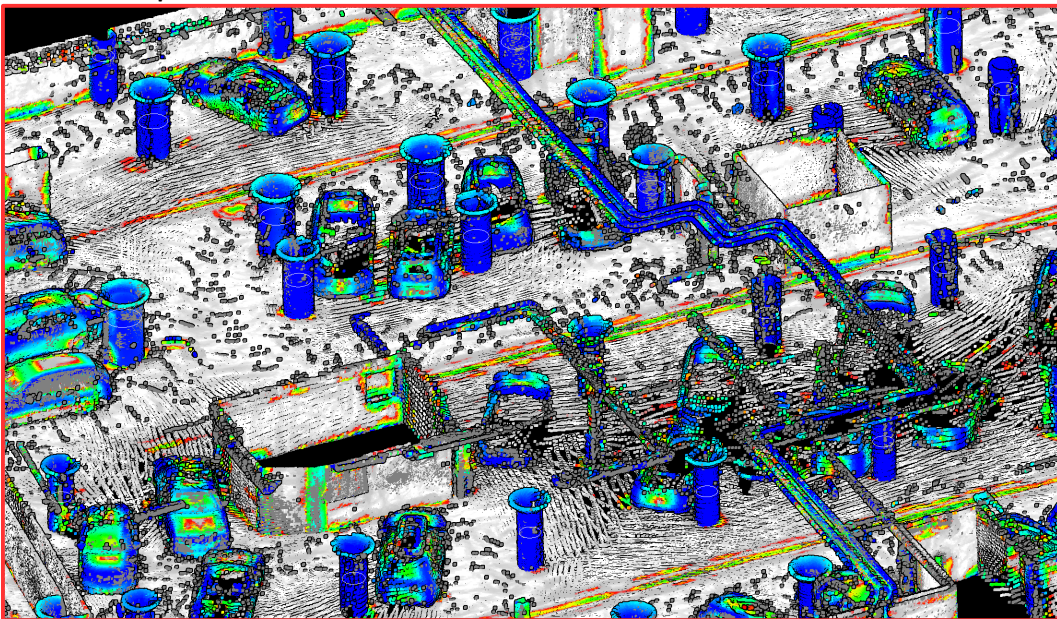
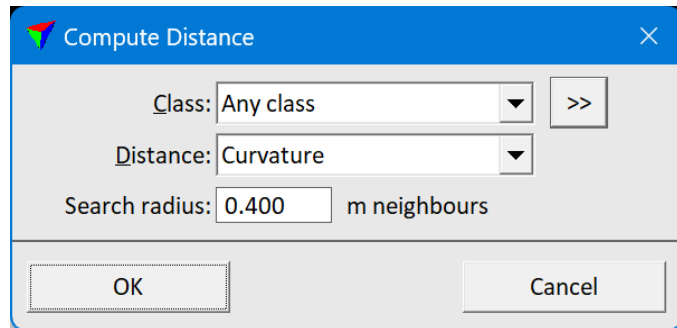
- Grey scale display mode which needs only xyz
- Automatically fits grey scale color scheme to depth range of points





# Compute Distance & Curvature

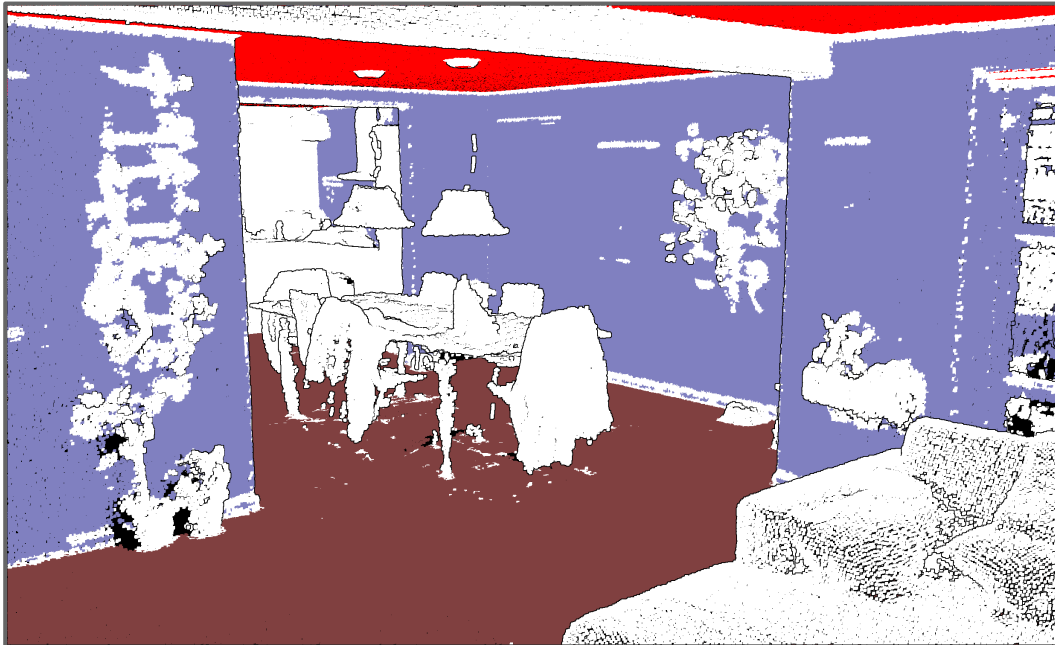
- **Compute Distance** has new option: **Curvature**
- **Compute normal vector** computes local planarity – hits on a large planar wall and hits on a pillar both get planar dimension
- **Curvature** option in **Compute Distance** lets user specify neighbourhood radius
- Hits on a pillar get small radius matching radius of the pillar
- Hits on large planar wall get big radius value



# Classify / Building surfaces



- Classifies points into floor, roof and wall classes
- Requires normal vectors
  - Floor has normal vectors pointing up
  - Roof has normal vectors pointing down
  - Wall has horizontal normal vectors



**Classify Building Surfaces** [X]

From class: 1 - Default [v] >>

Floor to: 2 - Ground [v]

Roof to: 6 - Building roof [v]

Wall to: 9 - Wall [v]

Floor normal < 10.0 deg from vertical

Roof normal < 10.0 deg from vertical

Wall normal < 10.0 deg from horizontal

Wall height > 1.50 m

Expansion radius: 0.200 m

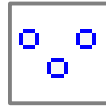
Plane tolerance: 0.025 m

Minimum area: 0.5 m<sup>2</sup>

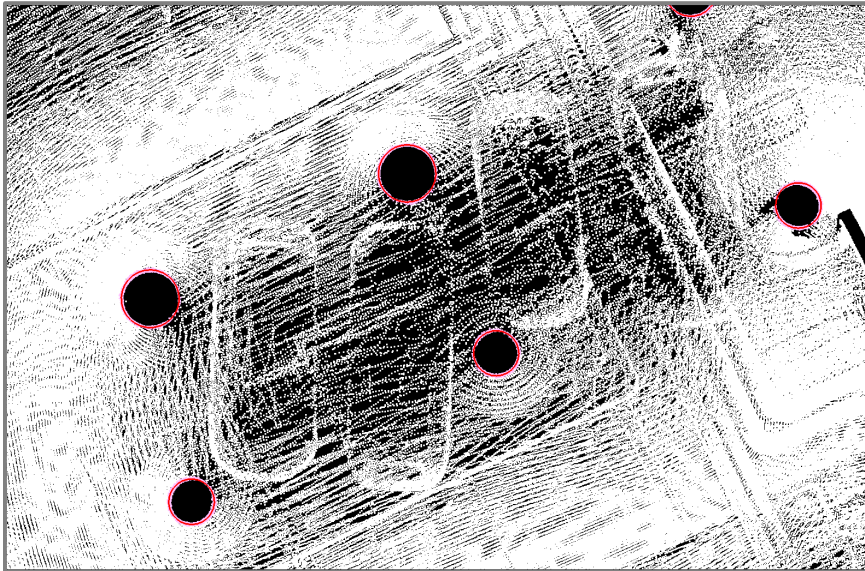
Inside fence only

OK Cancel

# Find Circles



- Finds 2D circles from loaded points
- 2D circle has:
  - Several points within given tolerance distance from circle edge
  - Clearly fewer points inside circle than close to edge
- Tool classifies points and optionally draws circles



Find Circles

From class: 1 - Default >>

To class: 18 - Pilar

Diameter: 0.600 - 1.100 m

Tolerance: 0.040 m

Max inside: 10 % of points

Min coverage: 60 deg of circle

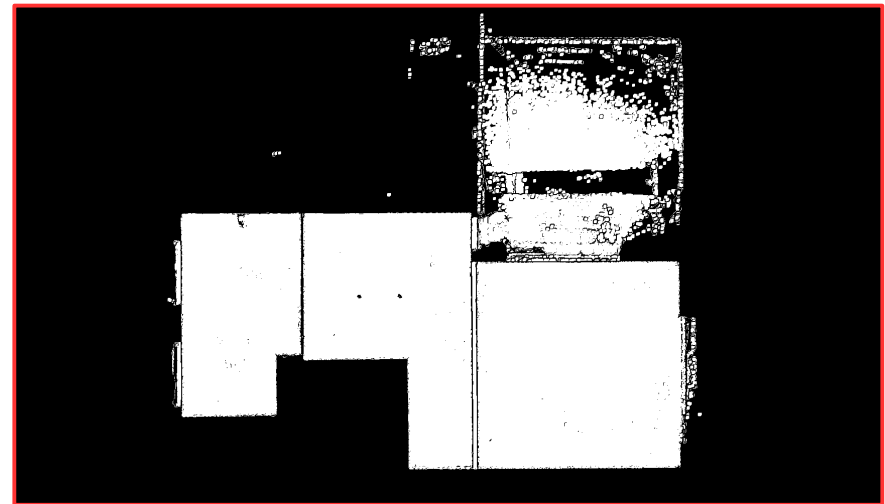
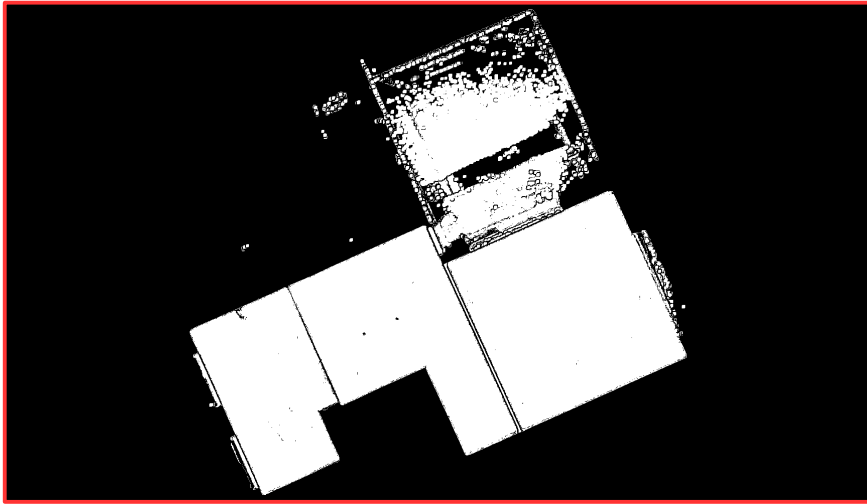
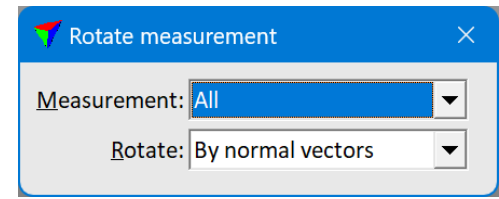
Inside fence only

Draw circles

OK Cancel

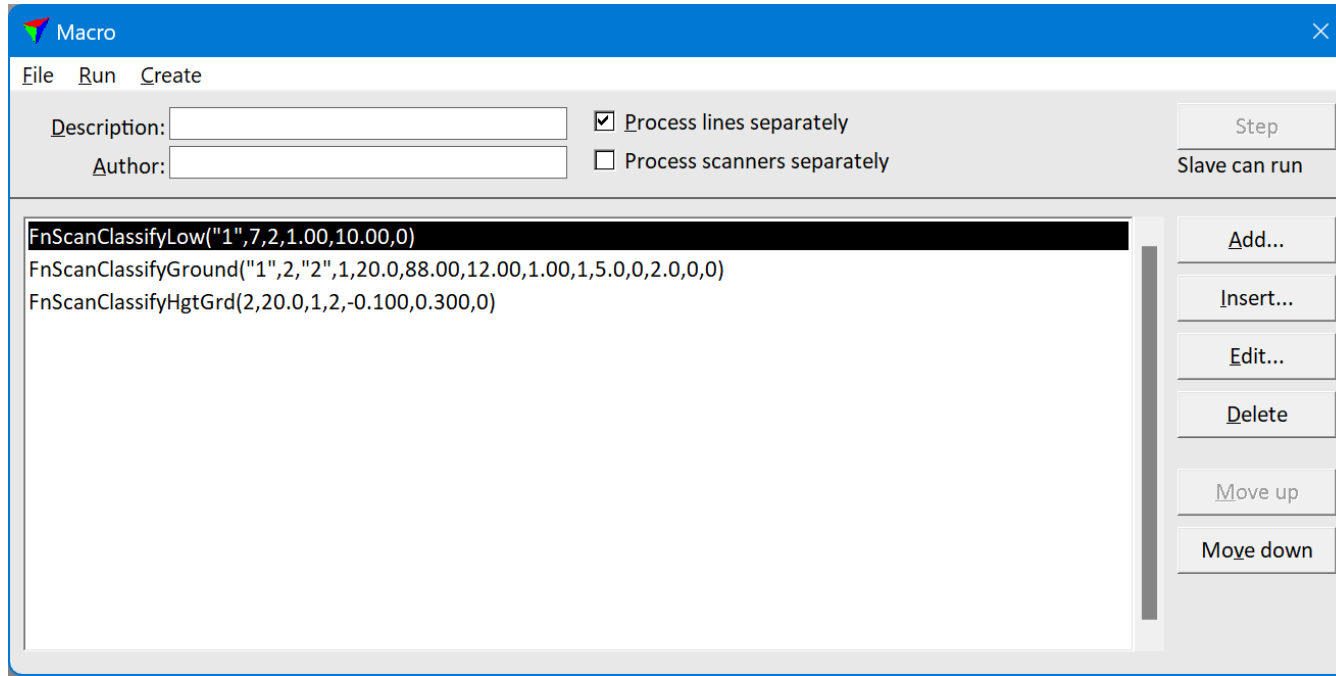
# Line / Rotate Improvements

- Can rotate point cloud based on dominant normal vector direction
- Can rotate point cloud 90 degrees clockwise, 180 degrees or 90 degrees counter clockwise



# Create / Ground per line macro

- Menu command in macro window
- Creates a macro for classifying ground per line
- Macro steps are identical to what **Match points** step does in **Process Drone Data**





# Create / Height from ground macro



- Menu command in macro window
- Creates a macro for classifying low, medium and high vegetation

Height From Ground Macro

Low vegetation:  m from ground

High vegetation:  m from ground

OK Cancel

Macro

File Run Create

Description:

Author:

Process lines separately

Process scanners separately

Step

Slave can run

```
FnScanDistClass("Any", "2")
FnScanClassifyClass("1", 3, 0)
FnScanClassifyDistance("3", 4, 0.250, 99999.990, 0)
FnScanClassifyDistance("4", 5, 2.000, 99999.990, 0)
```

Add...

Insert...

Edit...

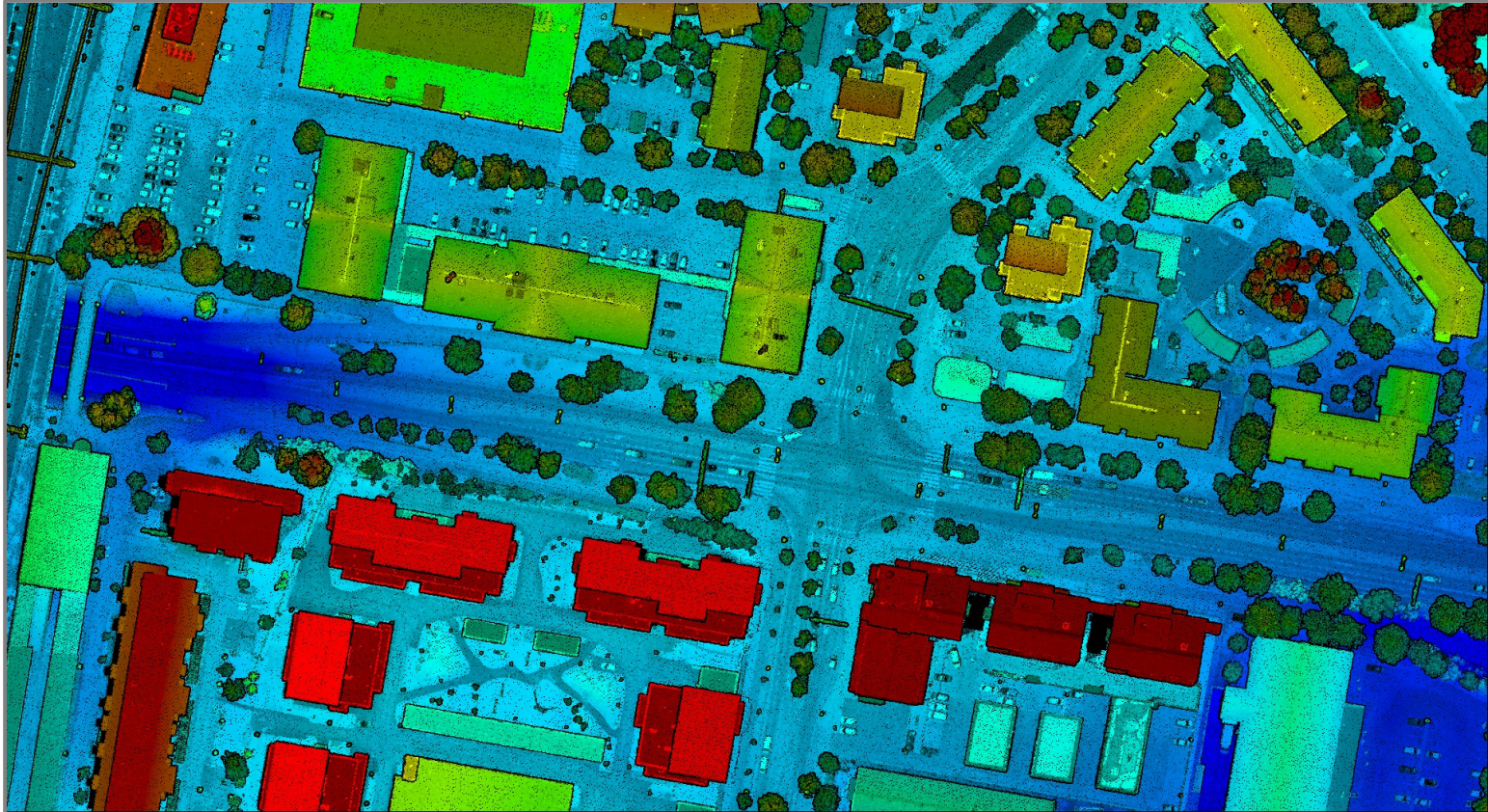
Delete

Move up

Move down

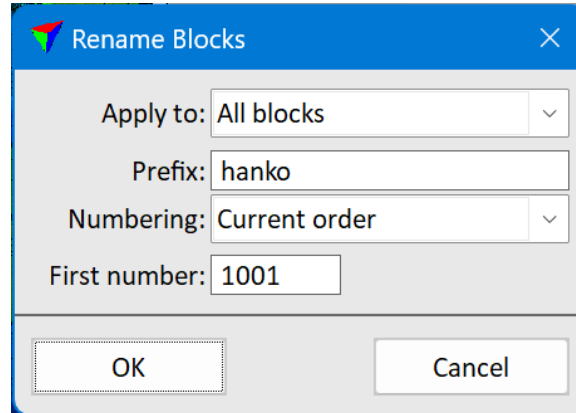
# 'Elevation+intensity' Coloring Mode

- Elevation gives color, intensity gives brightness



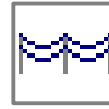
# Rename blocks

- Menu command in project window for renaming/renumbering blocks
- Renames information in project definition and renames file

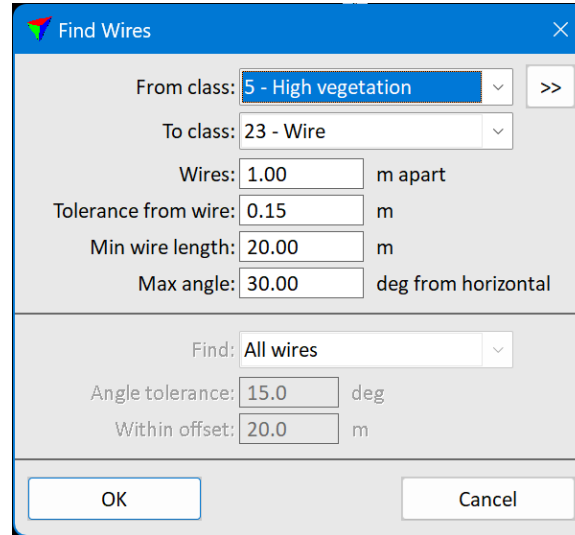


The screenshot shows a dialog box titled "Rename Blocks" with a close button (X) in the top right corner. The dialog contains four input fields: "Apply to:" with a dropdown menu set to "All blocks", "Prefix:" with a text box containing "hanko", "Numbering:" with a dropdown menu set to "Current order", and "First number:" with a text box containing "1001". At the bottom of the dialog are two buttons: "OK" and "Cancel".

# Find Powerline Wires



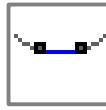
- Tool for finding powerline wires without tower string
- Only needs high vegetation classification done



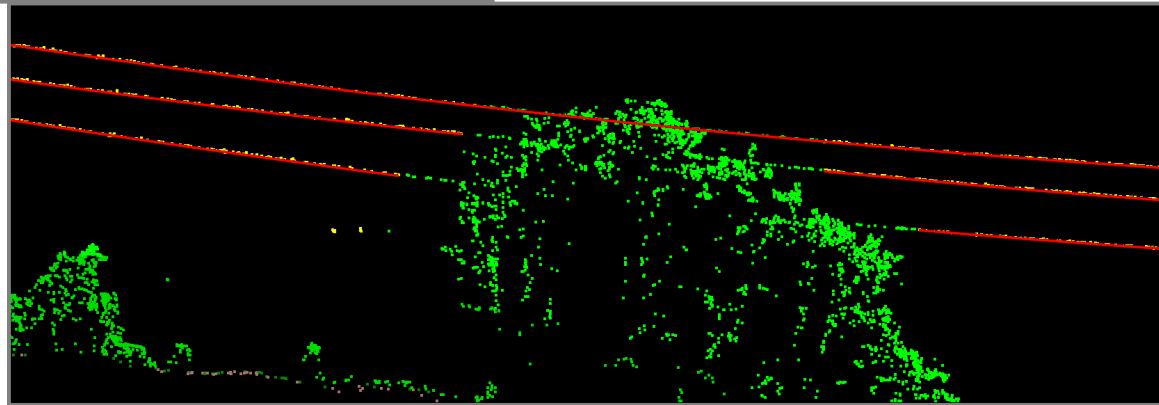
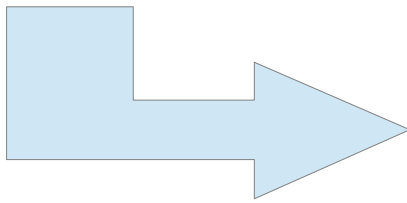
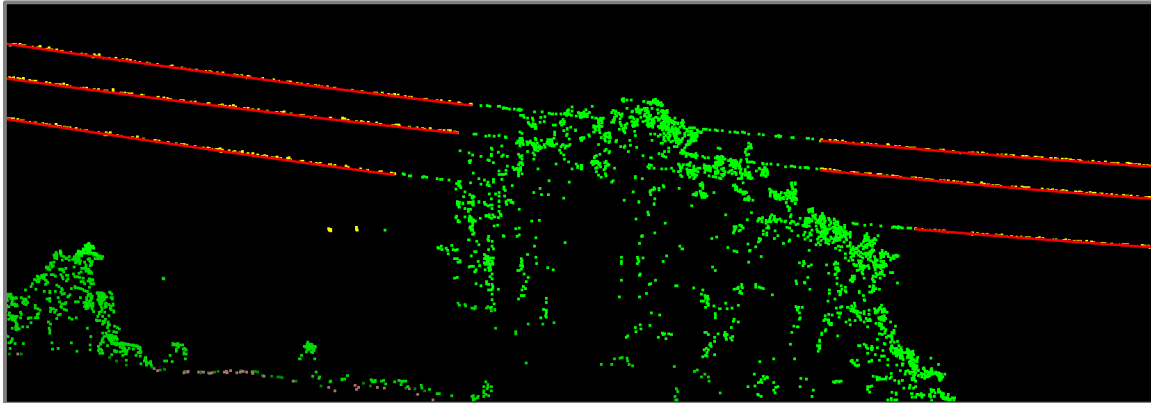
The screenshot shows a software dialog box titled "Find Wires". It contains several input fields and dropdown menus for configuring the search parameters. The "From class" dropdown is set to "5 - High vegetation" and has a right-pointing arrow button. The "To class" dropdown is set to "23 - Wire". The "Wires" field is set to "1.00" with the unit "m apart". The "Tolerance from wire" field is set to "0.15" with the unit "m". The "Min wire length" field is set to "20.00" with the unit "m". The "Max angle" field is set to "30.00" with the unit "deg from horizontal". Below these fields is a "Find:" dropdown set to "All wires". At the bottom, there are "Angle tolerance:" and "Within offset:" fields, both set to "15.0" and "20.0" respectively, with units "deg" and "m". The dialog box has "OK" and "Cancel" buttons at the bottom.

From class:	5 - High vegetation	>>
To class:	23 - Wire	
Wires:	1.00	m apart
Tolerance from wire:	0.15	m
Min wire length:	20.00	m
Max angle:	30.00	deg from horizontal
Find:	All wires	
Angle tolerance:	15.0	deg
Within offset:	20.0	m

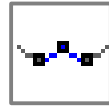
# Merge Wires



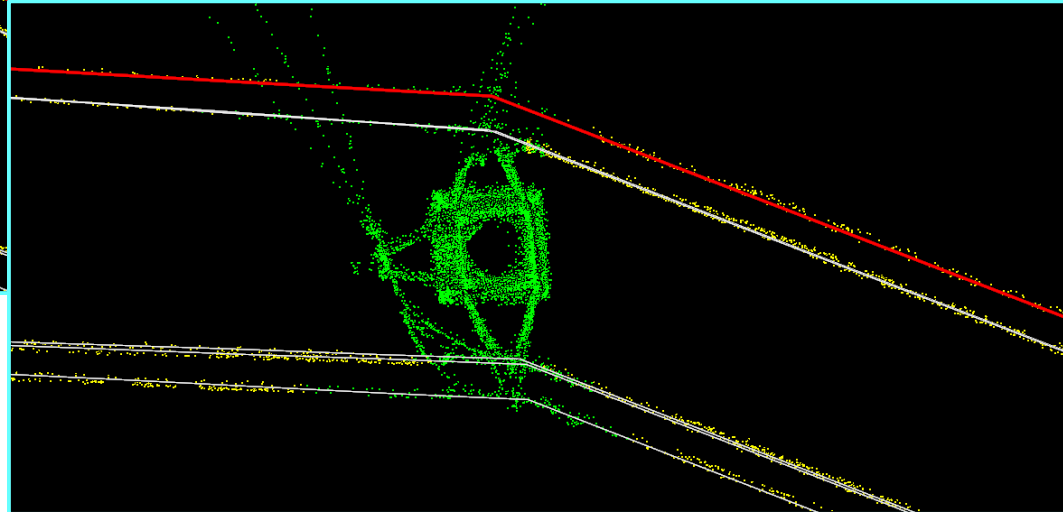
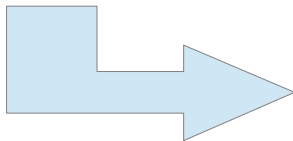
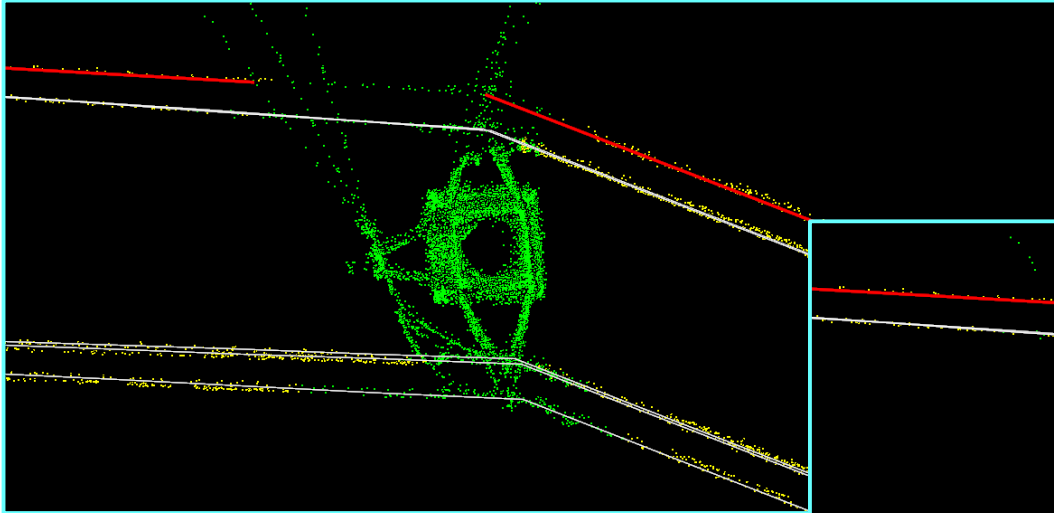
- Tool for merging two wire fragments into one vector



# Connect Wires



- Tool for connecting two wire vectors at meeting point
- Adjusts wire line equations so that match is perfect





# Pix4D and Metashape in Wizard

- Support for photogrammetric point clouds added to wizard

**New Drone Project**

Scanner system: Metashape

Project name: Hanasaari  Create default point classes

Point cloud: E:\agisoft\hanasaari\_p1\Hanasaari\_P1\_SM\_vain\_hyvät\_pc.las 01.08.2021

Input system: 4326 >> 4326 WGS84 longitude & latitude  Remove duplicate points

Input elevations: Ellipsoidal  Assign color to black points

Sort points for speed

Target system: 3132 >> 3132 ETRS89 / ETRS-GK25FIN E24.84 N60.16

Target elevations: Orthometric -> E491114 N6672330

Geoid model: Finland - FIN2005

Storage folder: E:\agisoft\hanasaari\_p1\

**Process Drone Data**

Cut low reliability

Smoother and remove noise

Thin points to inactive

Classify ground

Check ground

Classify height from ground

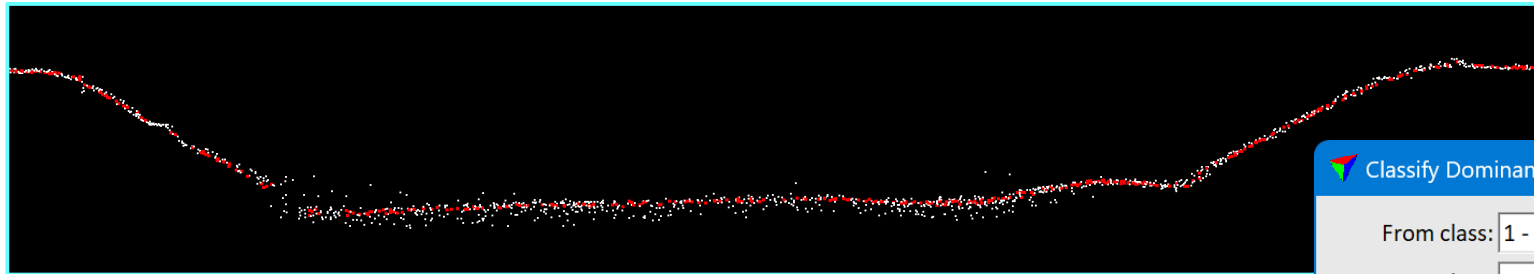
Classify above ground features

Copy result to inactive points

Copy result to noise points

# Classify / Dominant surface

- New ground classification routine
- Classifies dominant surface or points which have the biggest number of neighbours matching some plane equation going thru that point
- Classifies median points of strongest surface in data which may have noise below and above the surface



Classify Dominant Surface

From class: 1 - Default >>

To class: 8 - Model keypoint

Max slope: 45.000 deg

Tolerance: 0.100 m

Ignore limit: 8.0 % or lower plane match

Spacing: 1.000 m

Inside fence only

OK Cancel

# Add only upward points

- New setting in ground classification
- Useful when you want to add points to already classified ground only molding surface upwards



**Classify Ground**

**Classes**

From class: 1 - Default >>

To class: 2 - Ground >>

Current ground: 2 - Ground >>

Inside fence only

**Initial points**

Select: Current ground points only

**Classification maximums**

Terrain angle: 88.00 degrees

Iteration angle: 25.00 degrees to plane

Iteration distance: 1.40 m to plane

**Classification options**

Reduce iteration angle when

Edge length < 5.0 m

Stop triangulation when

Edge length < 2.00 m

Use Distance as rating

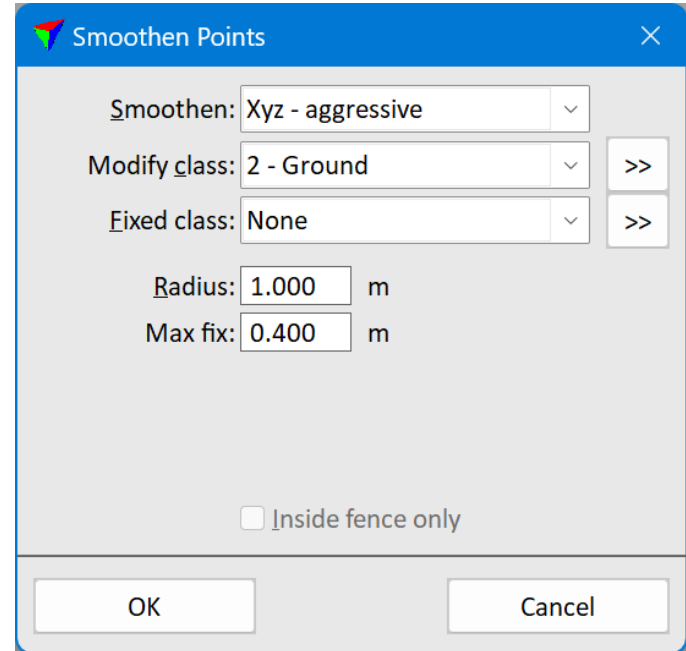
Weight: 50 %

Add only upward points

OK Cancel

# Smoothen Points / Xyz – Aggressive

- New smoothing routine
- Can produce a really smooth surface removing bumps which have a high number of points
- Use only if:
  - Data has bumps which are not real
  - Or you are OK with losing terrain features



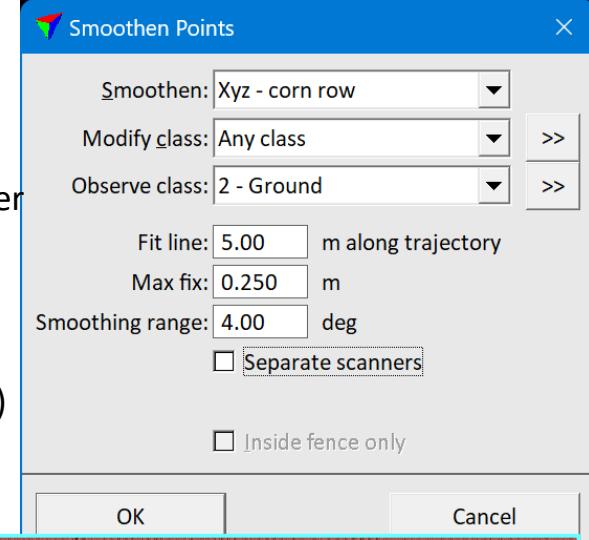
The screenshot shows a software dialog box titled "Smoothen Points". It contains several configuration options:

- Smoothen:** A dropdown menu set to "Xyz - aggressive".
- Modify class:** A dropdown menu set to "2 - Ground", with a right-pointing arrow button (>>) to its right.
- Fixed class:** A dropdown menu set to "None", with a right-pointing arrow button (>>) to its right.
- Radius:** A text input field containing "1.000" followed by the unit "m".
- Max fix:** A text input field containing "0.400" followed by the unit "m".
- Inside fence only:** An unchecked checkbox.

At the bottom of the dialog are two buttons: "OK" and "Cancel".

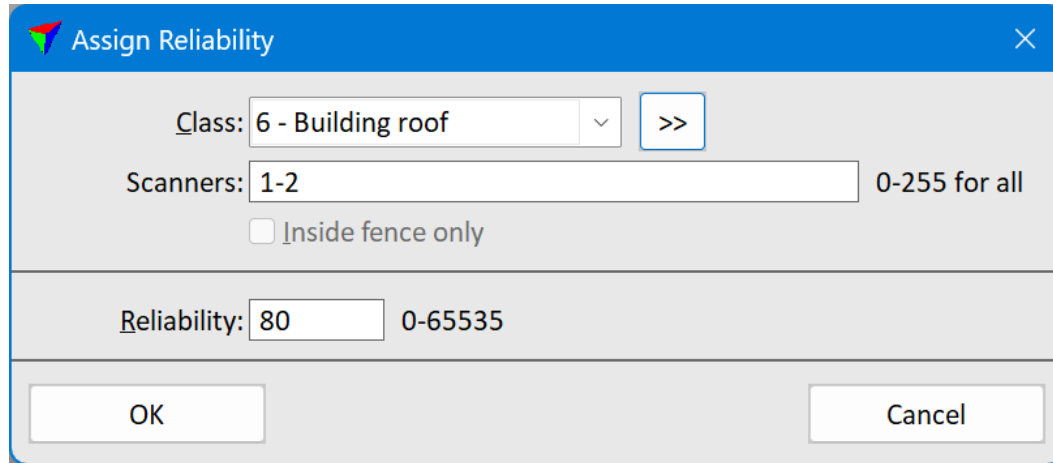
# Smoothen Points / Xyz – Corn Row

- Smoothing written for data where consecutive scanlines do not match each other
- Computes a roll/mirror angle correction for points
- Observations built by fitting a line to a narrow cross section along trajectory
- Applies smoothing to correction values along scanline (given mirror angle range)
- Requires:
  - Trajectories
  - Mirror angle values
  - Ground classified per line



# Assign / Reliability

- Menu command for assigning reliability values to points by class
- Makes it possible to modify what gets removed in **Cut low reliability**



The dialog box titled "Assign Reliability" has a blue header bar with a close button (X) on the right. The main area is light gray and contains the following controls:

- Class:** A dropdown menu showing "6 - Building roof" with a downward arrow, followed by a blue button with ">>" text.
- Scanners:** A text input field containing "1-2" and a range indicator "0-255 for all" to its right.
- Inside fence only**
- Reliability:** A text input field containing "80" and a range indicator "0-65535" to its right.
- At the bottom, there are two buttons: "OK" on the left and "Cancel" on the right.

