



**POINT CLOUD INTELLIGENCE**

**DATA FUSION**

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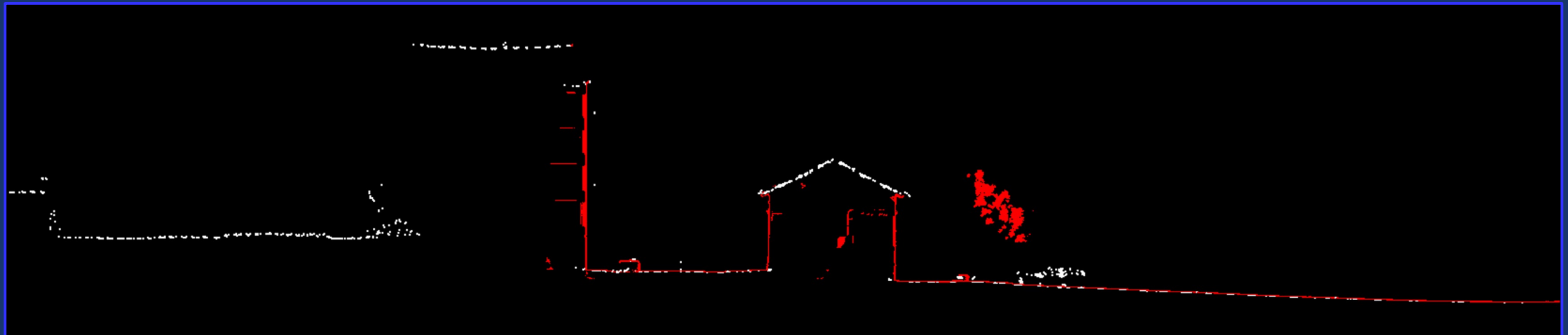
**GWF**

GEOSPATIAL WORLD FORUM

2-5 May 2023, Rotterdam, The Netherlands

# Merging Point Clouds from Different Sensors

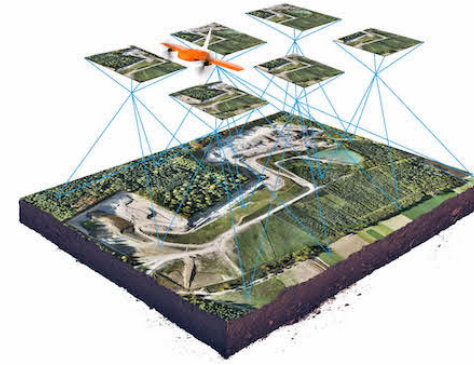
- Different sensors see different surfaces – merging produces a more complete model
- Merging requires planning and many decisions on how to merge
- Matching positioning is of vital importance
- Time difference between surveys complicates process



*Airborne laser - white/mobile laser - red*

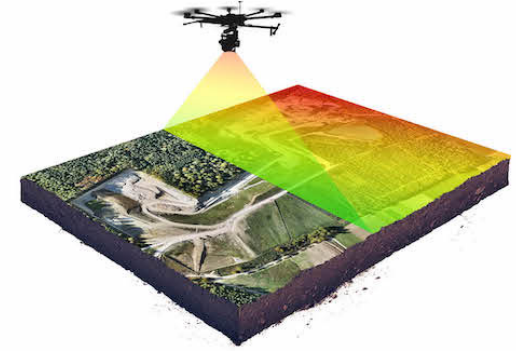
# Sensors for Creating Point Clouds

**ALL POINT CLOUDS  
NO MATTER THE SOURCE  
NO MATTER THE SENSOR  
NO MATTER THE SIZE**



**PHOTOGRAMMETRY**

Image: Wingtra



**LASER SCANNING**



**ALS** Image: HELINET



**MLS** Image: TOPCON



**UAV** Image: Phoenix LiDAR

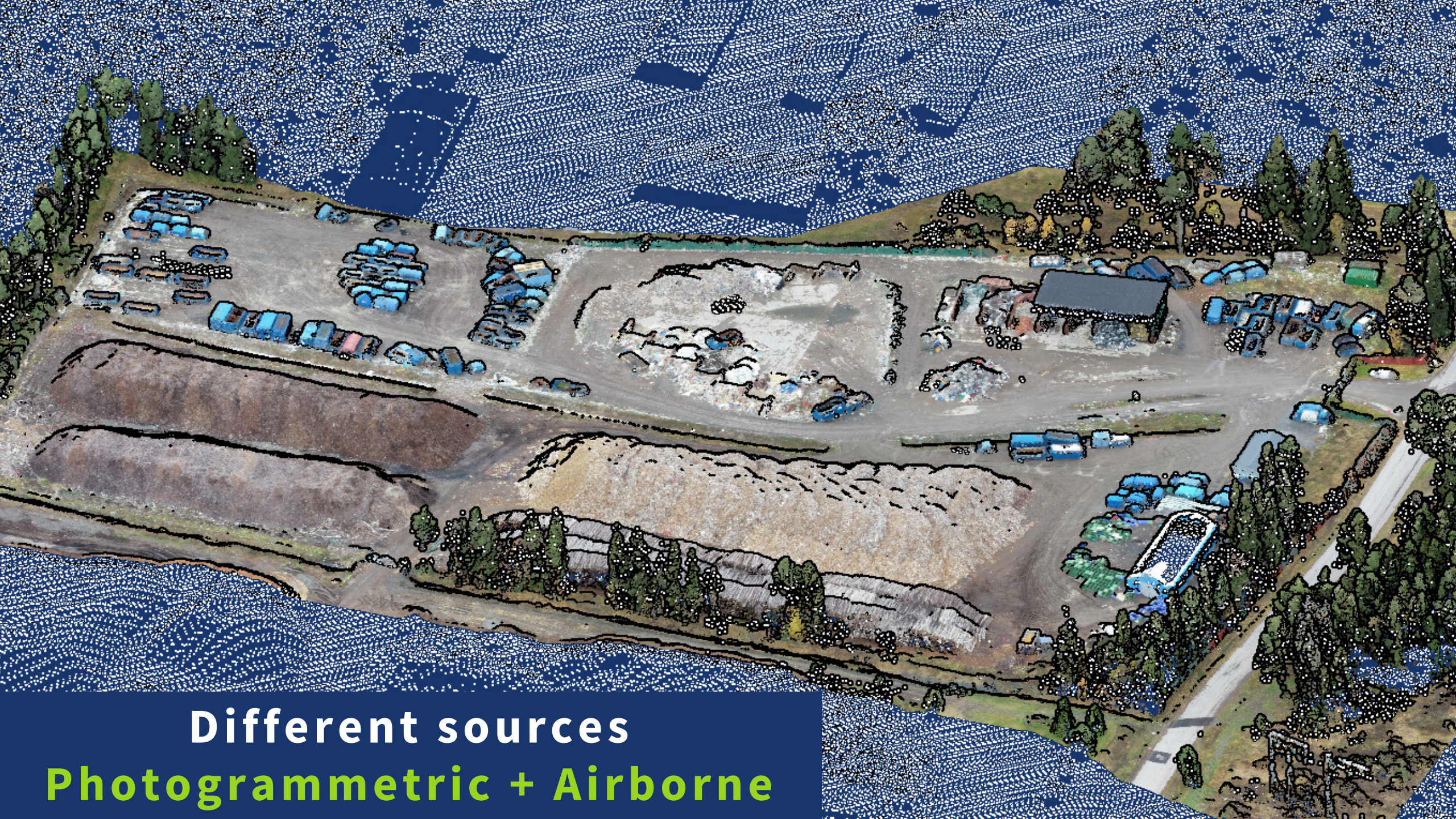


**HANDHELD** Image: GEO-SLAM

# Different sources

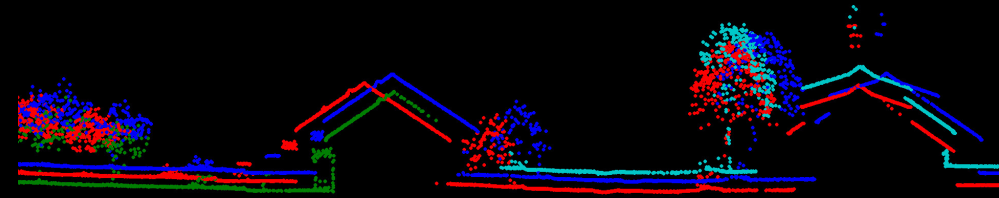
## Airborne + Mobile





**Different sources**  
**Photogrammetric + Airborne**

# Diversity of tools to merge the pointclouds



TerraScan

- On loaded points (smaller projects)
- No need trajectory or timestamps info (suitable for photogrammetric pointclouds)

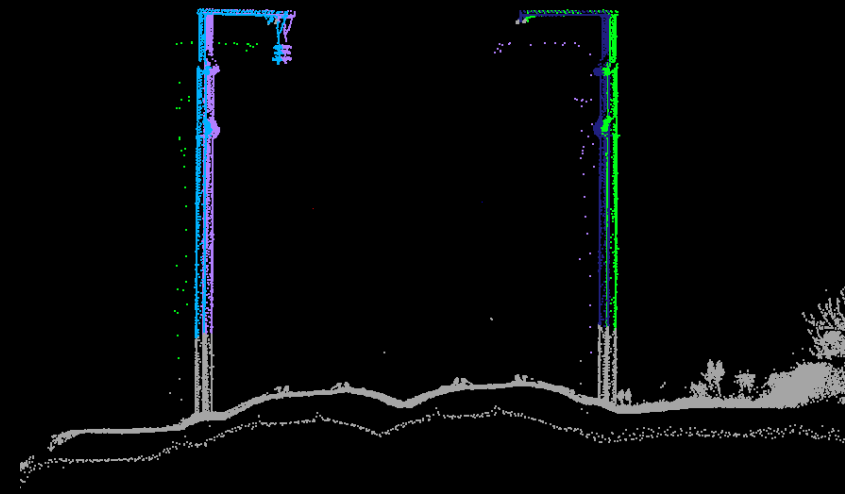


TerraMatch

- Possibility to run on project
- Trajectory information is used in matching process
- Can use different sources as reference



Number	SourceX	SourceY	SourceZ	TargetX	TargetY	TargetZ	Res X	Res Y	Res Z
1	170046.462	7011396.6				370.070	-0.005	+0.017	-0.025
5	169986.465	7011234.7				316.808	0.029	+0.014	-0.004
2	170117.996	7011256.1				330.118	-0.023	-0.003	-0.017
3	170209.010	7011263.0				323.242	+0.011	+0.026	+0.019
4	170174.630	7011216.1				321.969	+0.001	-0.053	-0.027





TerraScan

MANUAL  
drag & drop

SEMI-AUTOMATIC  
Match to GCPs

AUTOMATIC  
Fit to reference



Number	SourceX	SourceY	SourceZ
-	170174.660	7011216.168	320.021
-	170209.054	7011263.122	321.316
-	170117.955	7011296.190	318.218

Show location    Add source



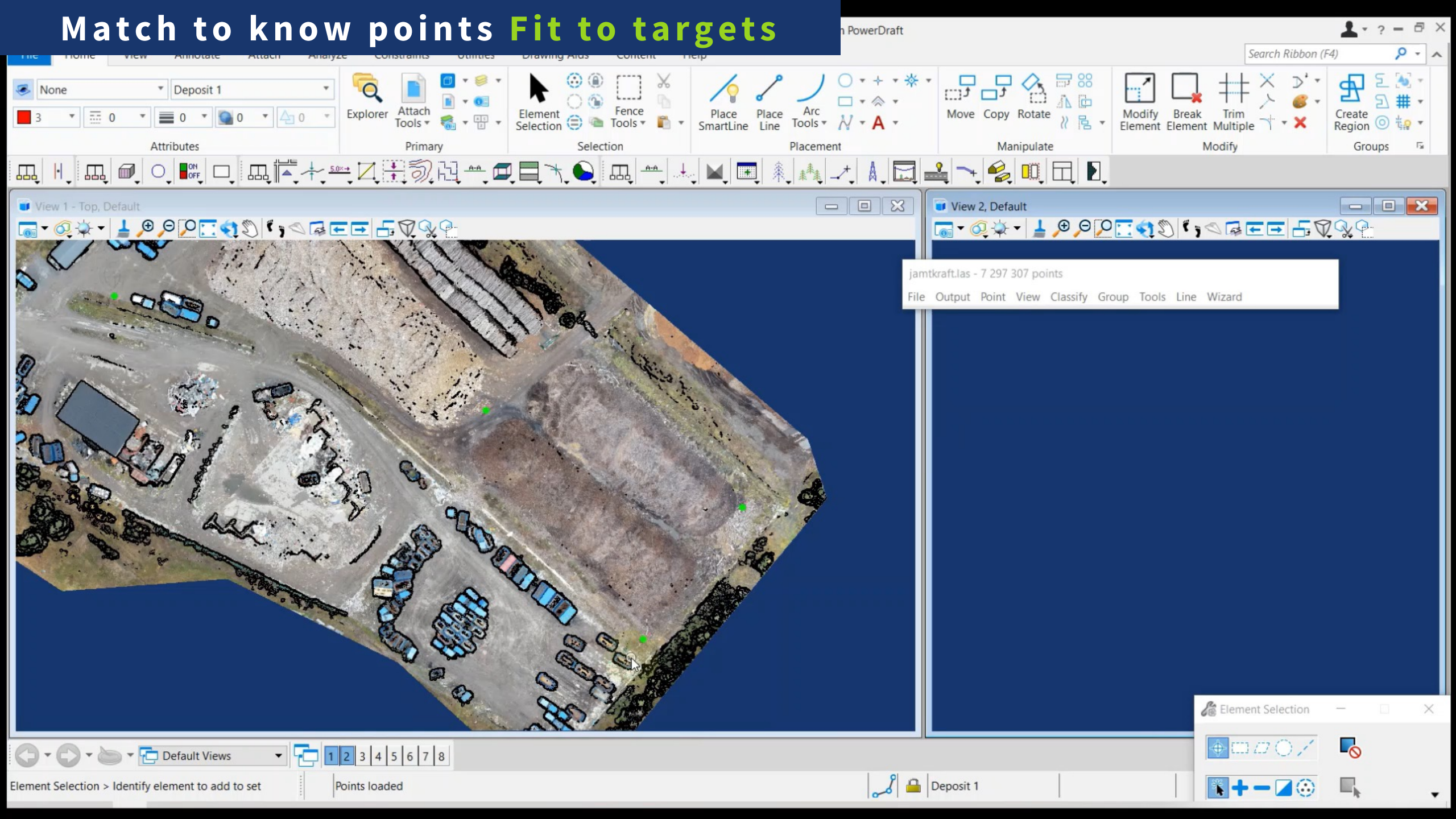
# Drag & drop **Rotate & Translate**

The screenshot displays a CAD software interface with a 3D model of a building complex on the left and a data table on the right. The software has a ribbon menu with tabs for File, Home, View, Annotate, Attach, Analyze, Curves, Constraints, Utilities, Drawing Aids, Content, and Help. The ribbon includes various tool groups such as Explorer, Attach Tools, Element Selection, Fence Tools, Place SmartLine, Place Line, Arc Tools, Move, Copy, Rotate, Modify Element, Break Element, Trim Multiple, Create Region, and Groups. The 3D model shows a building with a roof and walls, surrounded by trees and a parking lot. The data table is titled "lugnvik\_moved.las - 7 297 307 points" and contains a list of points with their coordinates and other attributes.

File	Output	Point	View	Classify	Group	Tools	Line
0	65535	-	170562.164	2856817.580	+319.235	26214	1/1 0
0	65535	-	170561.757	2856817.358	+319.226	34695	1/1 0
0	65535	-	170561.807	2856817.271	+319.236	40606	1/1 0
0	65535	-	170562.084	2856816.987	+319.301	31611	1/1 0
0	65535	-	170561.615	2856817.868	+319.253	28270	1/1 0
0	65535	-	170561.862	2856817.429	+319.235	32382	1/1 0
0	65535	-	170561.679	2856817.751	+319.221	26214	1/1 0
0	65535	-	170561.915	2856817.311	+319.245	41891	1/1 0
0	65535	-	170561.984	2856816.916	+319.360	31611	1/1 0
0	65535	-	170561.324	2856820.453	+319.328	41120	1/1 0
0	65535	-	170561.389	2856820.366	+319.365	40606	1/1 0
0	65535	-	170562.065	2856817.785	+319.284	27756	1/1 0
0	65535	-	170561.875	2856817.153	+319.273	37008	1/1 0
0	65535	-	170562.127	2856817.699	+319.252	29812	1/1 0



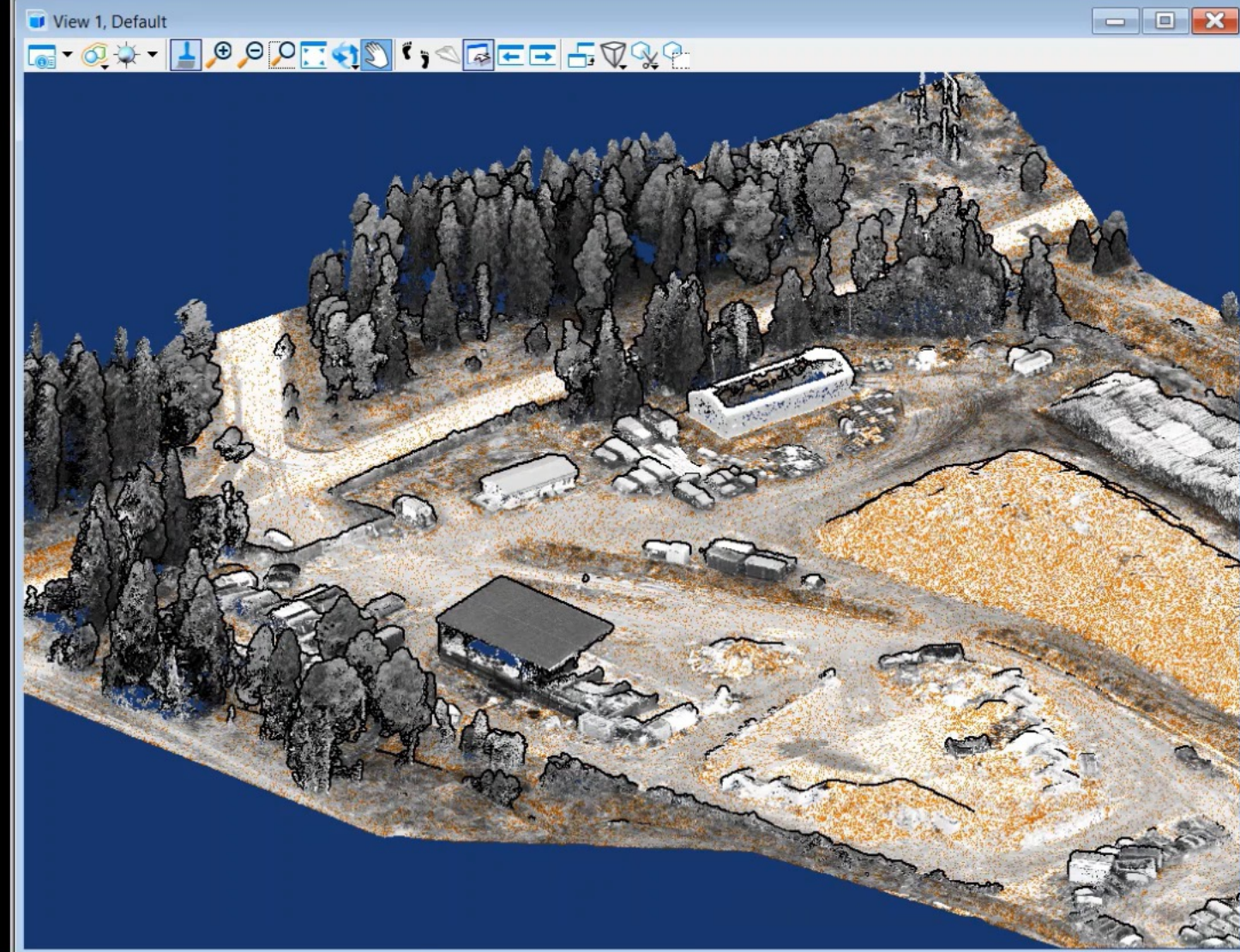
# Match to know points **Fit to targets**



# Automatic Fit to reference

Drawing Ostersund.dgn [3D - V8 DGN] - MicroSt

File Home View Annotate Attach Analyze Constraints Utilities Drawing Aids Content Help



View 2, Default

ground\_classified.las - 7 297 307 points

File Output Point View Classify Group Tools Line Wizard

A screenshot of a software interface showing a context menu for a point cloud. The menu is open, displaying options: File, Output, Point, View, Classify, Group, Tools, Line, and Wizard. The 'View' option is highlighted. The background is a dark blue gradient.

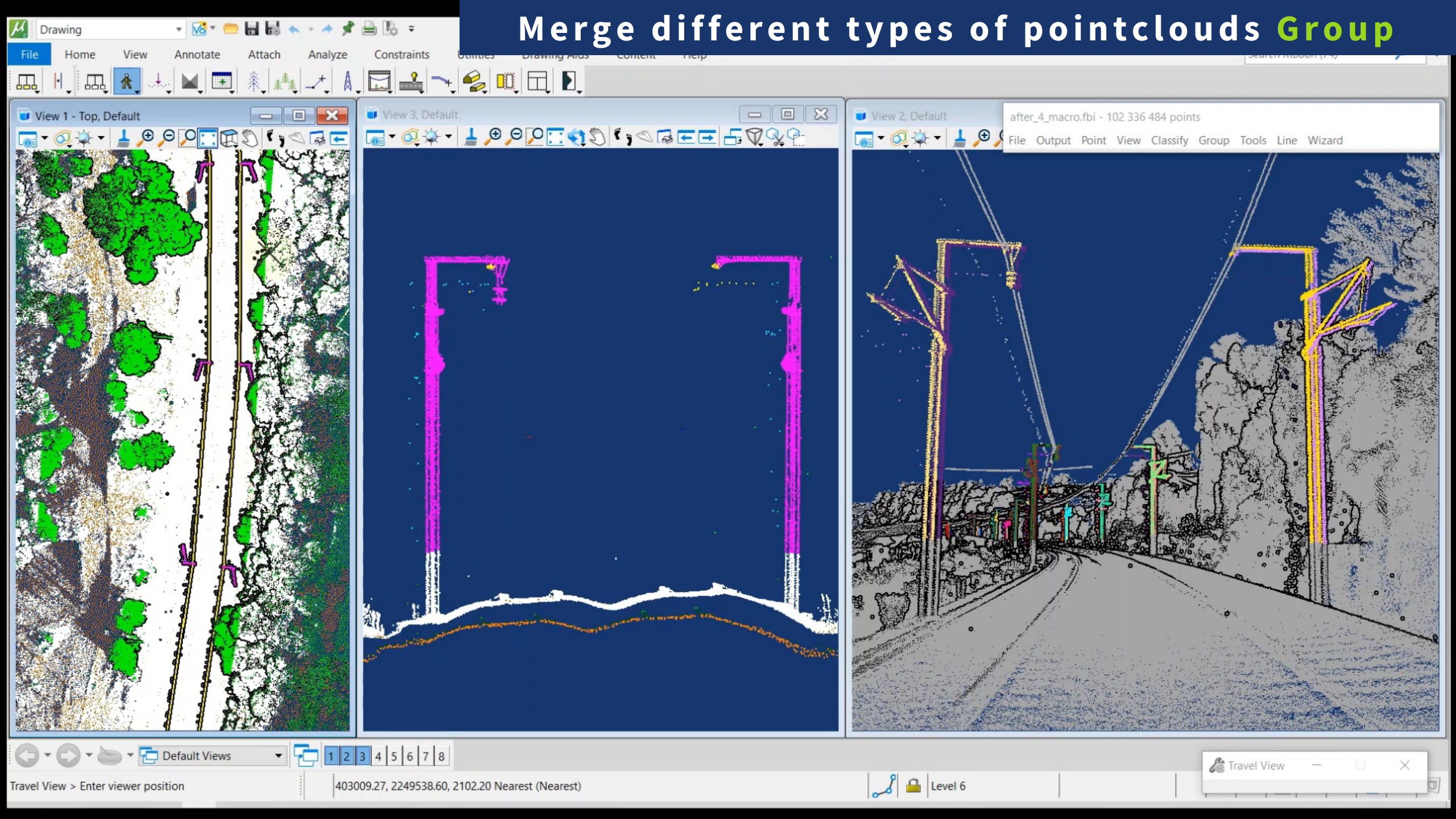
Default Views 1 2 3 4 5 6 7 8

Pan View > Select view USERPREF unloaded.

Deposit 1

Pan View - Move Camera

# Merge different types of pointclouds **Group**



# Which Points to Keep in Merged Data Set?

- Point clouds from different sensors overlap in many places
- Often best to use data from one sensor only on one surface
- Best to cut overlap (principles)
  - Manual cut – user draws polygons for cutting
  - By quality – keep data from more accurate sensor, remove all closeby points from another less accurate sensor
  - Can specify quality by time: latest is the best
  - By range – keep shorter measurement range points, remove all closeby points with longer measurement range
  - By density – keep data from locally highest density sensor, remove all closeby points from lower density sensor
  - By class – example: keep specific sensor on wall and on roof surfaces

The image shows a 'Macro step' dialog box with the following settings:

- Action:** Cut overlap
- Coverage:** Any
- Action:** Classify to single class
- To class:** 13 - Overlap
- Cut by quality  
Hole size: 10.0 m
- Cut single scanner edges  
Keep: 0 degree corridor
- Cut by offset  
Keep: 25 degree corridor
- Cut by scan angle  
Keep angles <= 10 deg
- Cut by range  
Use: 3D range  
Search radius: 0.100 m + 0.0000 \* range  
Keep range: 5.000 m from scanner
- Cut by density  
Search radius: 0.500 m  
Keep classes: 6,22,28  
Scanner groups: 1-2

Buttons: OK, Cancel

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TERRASCAN

**8**

INDUSTRY  
TOOLSETS

**Thank you for  
your attention!**

**Welcome to booth 39A**



# THE INDUSTRY STANDARD SOFTWARE FOR POINT CLOUD AND IMAGE PROCESSING



# TERRASOLID SOFTWARE RUNS ON CAD



**MicroStation, PowerDraft, etc.**  
**Channel Partner**  
**Product Robustness**



**Integrated**  
**Customizable**  
**Inexpensive**