

SLAM RobotSLAM/ME

TLS SPL-1500 Airborne SA130/SG130





Multiple Industrial Modules

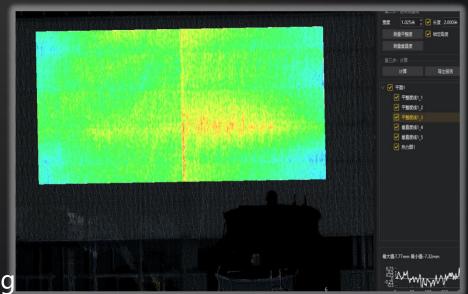


Professional Modules

DEM Production Profile Extraction

Power Lines Routing

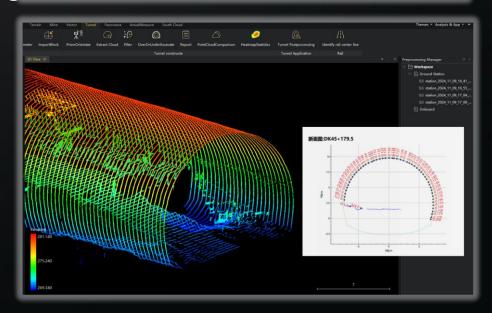
Flatness Check Tunnelling



基础模块

TLS: Point Cloud Registration

MLS/SLAM: Point Cloud Process & Adjustment

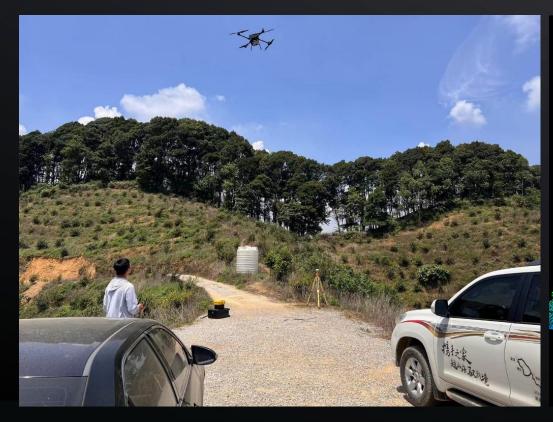


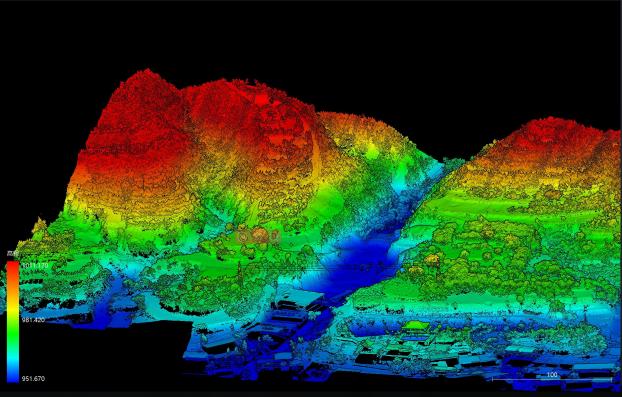


DOM/DEM/DLG

To represent true bare ground surface, point cloud is the most accurate.

Recommended: airborne





03 Geo-information — land title survey

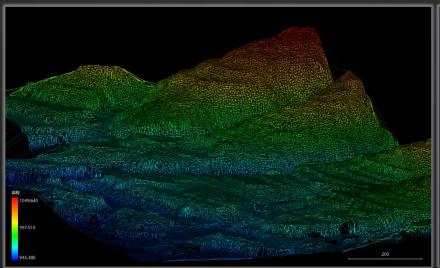


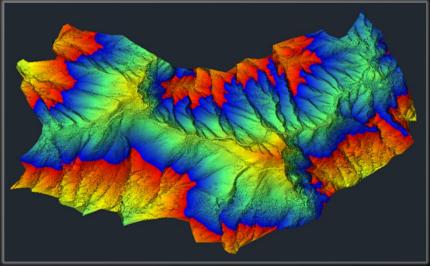
TIN

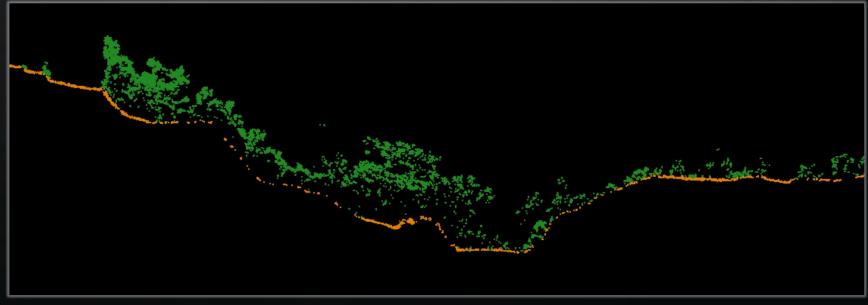
Intensive Classification

Triangulation Editing

Abundant Outputs







03 Geo-information — land title survey

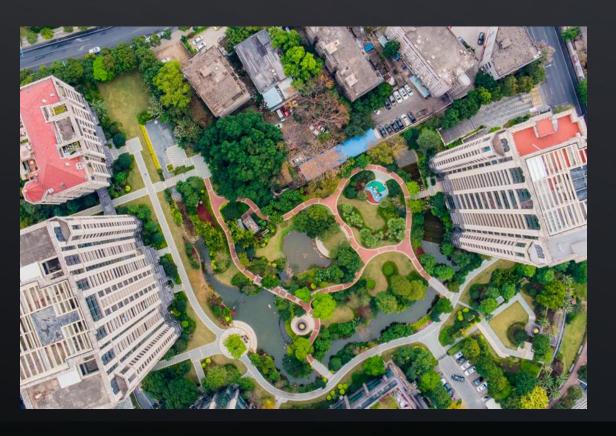


Boundary, façade, and floor plan.

Recommended: TLS/Airborne/SLAM







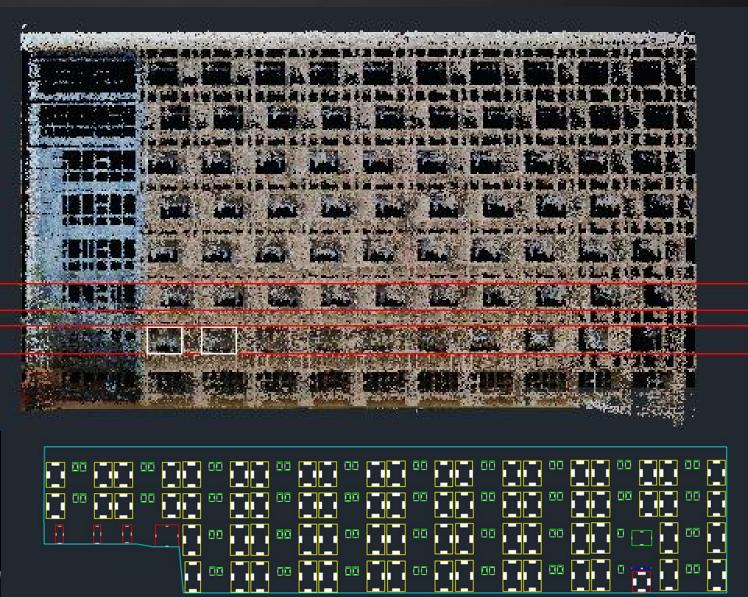
03 Geo-information — land title survey



Façade Drawing
Profile Drawing

Auto-draw Boundary

Outputs DWG/SHP



04 Construction Engineering - volume calculation & monitoring



For construction engineering and mining

Recommended: TLS/Airborne



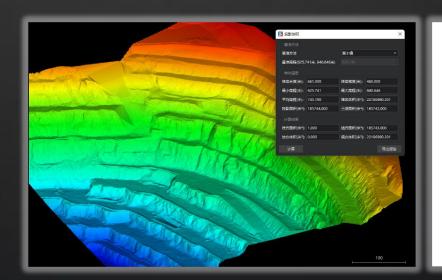


04 Construction Engineering - volume calculation & monitoring



- TIN algorithm
- Ground points to extract
- Triangulation
- Stockpile and irregular calculation

- Before & After comparison
- Heat-map to monitor



投影体积报告

模型名称:裁剪_20221008_c1_h1_2xR16L_01_dem 基准高程:625.741米

堆体信息

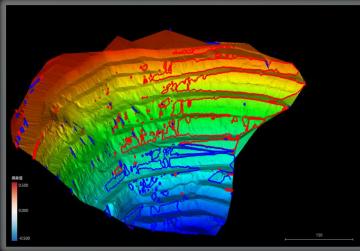
**************************************			_
堆体长度(米):	661.000	堆体宽度(米):	460.000
最小高程(米):	625.741	最大高程(米):	840.646
平均高程(米):	745.190	堆体体积(米³):	22186980.301
投影面积(米²):	185744.000	三维面积(米²):	185742.000

计算结果

挖方面积(米²): 1.000		填方面积(米²):	185743.000	
挖方体积(米³):	0.000	填方体积(米³):	22186980.301	

Volume Fill/Cut



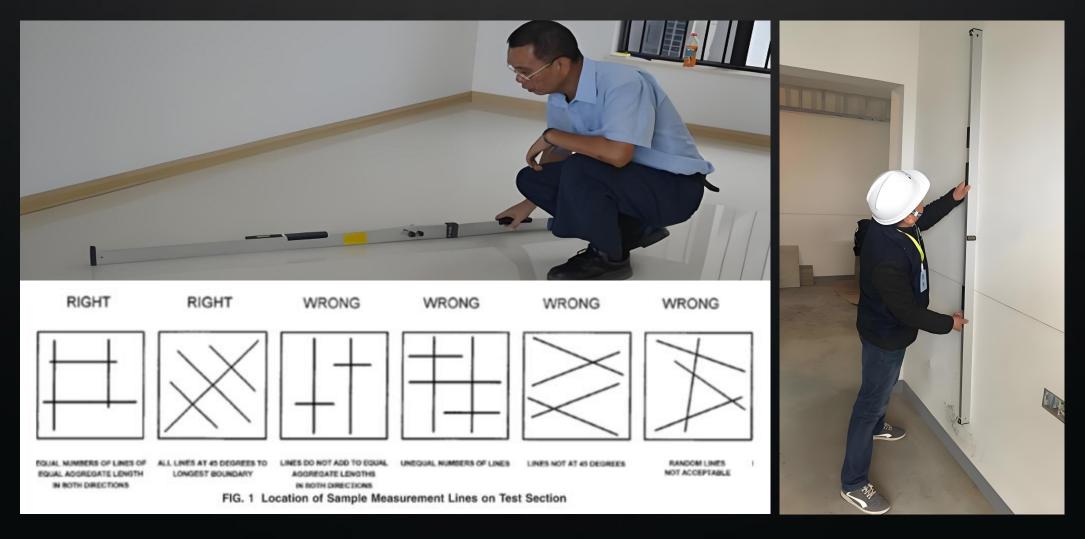


Progress Monitoring



Conventional methods: ruler, crossline laser, etc.

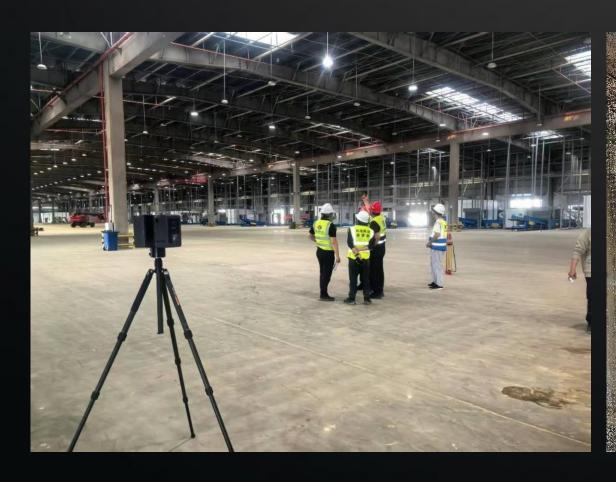
High labor costs, yet low efficiency



04 Construction - flatness & levelness verification



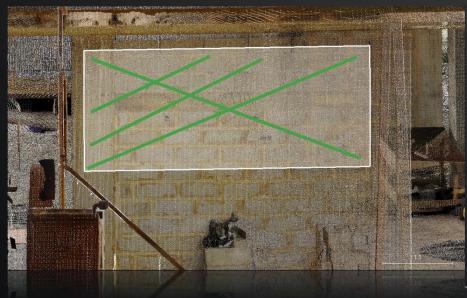
TLS to deploy





04 Construction - flatness & levelness verification



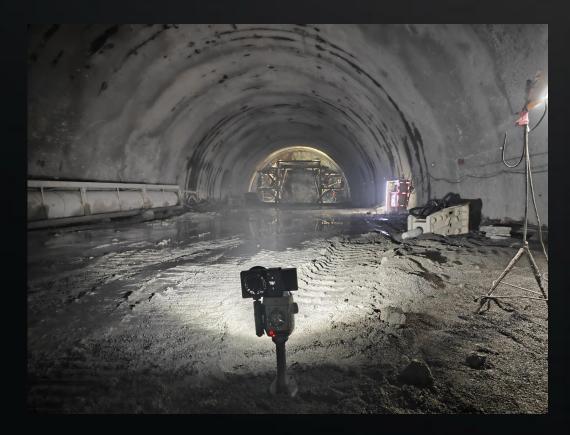


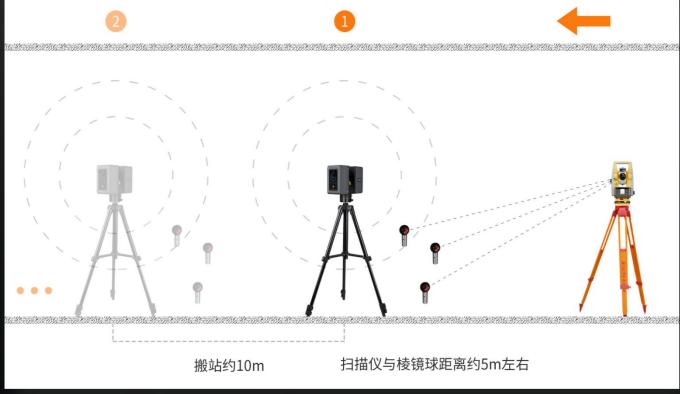




Fast and accurate measurements to compare with design data, then adjust tunneling method

Recommended: TLS/SLAM





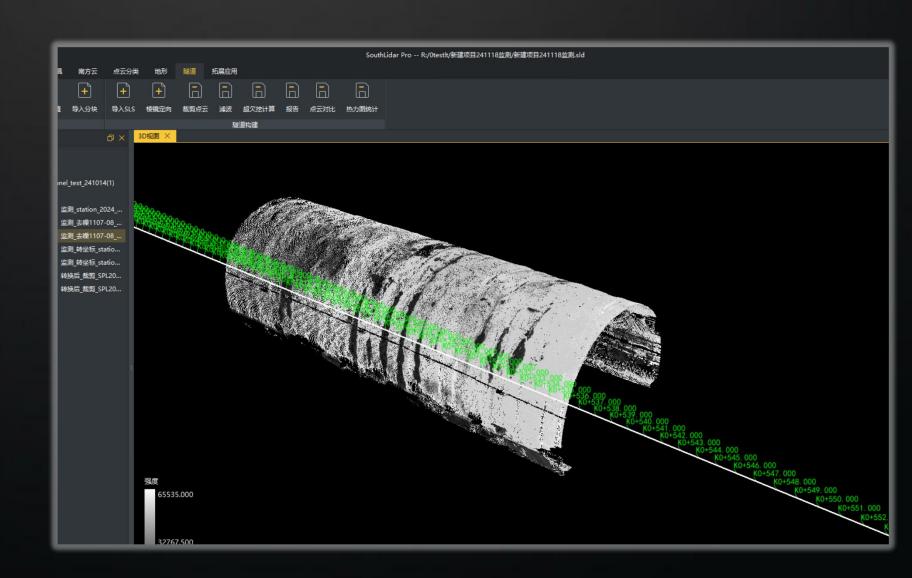
05 Tunneling - over & under excavation (based on TLS)



1. Transformation

2. Denoise & Crop

3. Extract Profile

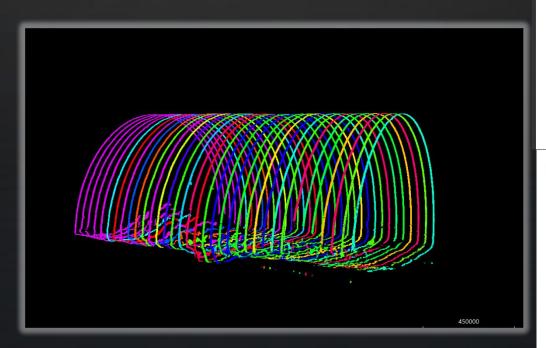


05 Tunneling - over & under excavation (based on SLAM)



Rapid Scan

Accuracy down to 2cm Report within 10min



隧道分析报告

首路详情

起始里程	28557.511	结束里程	50500.000
逐桩数量	10022		

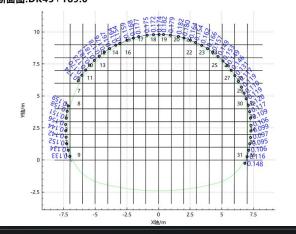
新面参数

里程段落		扫描点间距	0.5
断面间距	0.5	断面厚度	0.1

断面参数

名称	平均超挖	最小超挖	最大超挖	平均欠挖	最小欠挖	最大欠挖
DK45+186.0	0.124	0.076	0.164	0.000	0.000	0.000
DK45+186.5	0.135	0.078	0.178	0.000	0.000	0.000
DK45+187.0	0.135	0.061	0.213	0.000	0.000	0.000
DK45+187.5	0.135	0.073	0.169	0.000	0.000	0.000
DK45+188.0	0.142	0.076	0.170	0.000	0.000	0.000
DK45+188.5	0.149	0.084	0.188	0.000	0.000	0.000
DK45+189.0	0.149	0.095	0.183	0.000	0.000	0.000
DK45+189.5	0.145	0.083	0.181	0.000	0.000	0.000

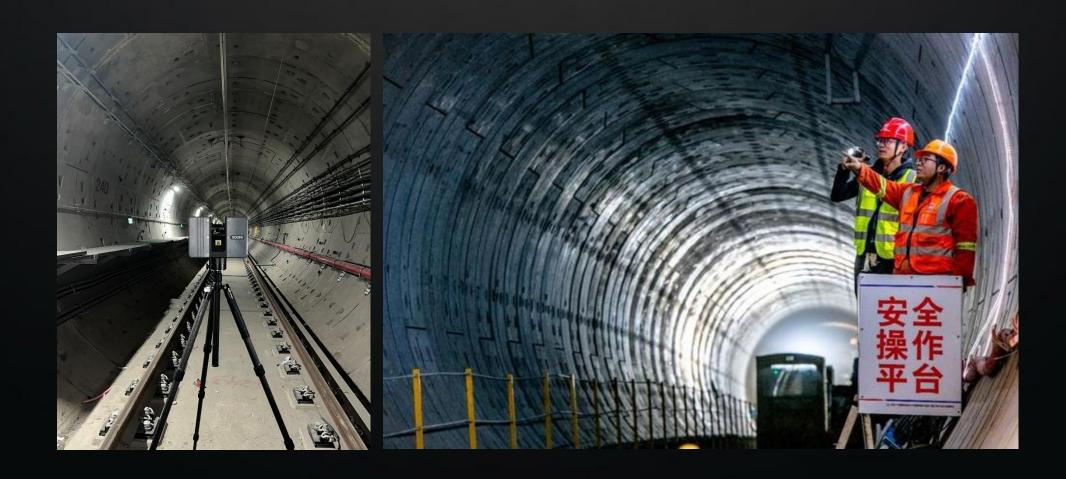
断面图:DK45+189.0





For shield tunnels, mid-line deviations and ovality inspection are needed.

Recommended: TLS



05 Tunneling - as-built survey



□ Sphere Detection Based on Depth Map

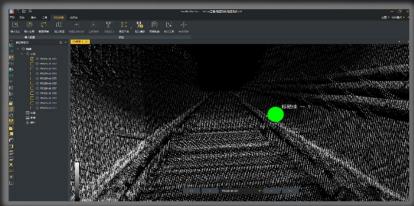
- 1. Pano depth map generated from TLS
- 2. Circle Hough inspection

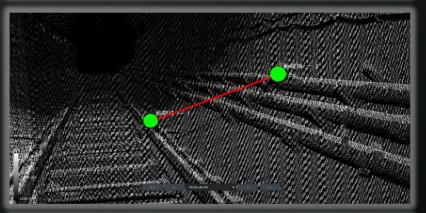
□ Coordinate Auto Match

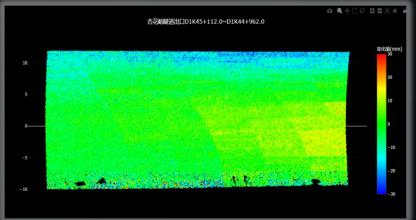
- 1. Geometric constraint of control points
- 2. Relative position, angle, distance, and topological structure
- 3. Spatial similarity and corresponding relationship

□ Tunnel Wall Extraction

- 1. Mid-line closure
- 2. Column projection
- 3. Circular orthophoto to extract ground points







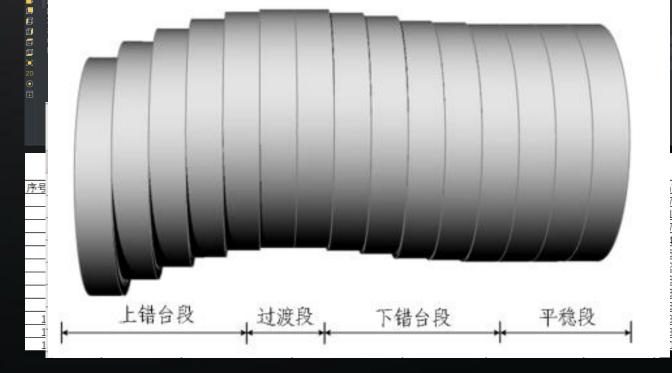
SOUTH Target your success

Mid-line Analysis

Ovality Analysis

Segment Stagger Analysis

Α						
	В	C	D	E	F	G
管环号	里程	最大错台(mm)	错台中位数(mm)	平均中位数值(mm)	错台标准(mm)	合格率(%)
1	18298.9	7.4	0.28	0.5	1.31	100
2	18316.9	5.79	-0.2	-0.08	1.15	100
3	18339.9	1.2	0	0.05	0.33	100
4	18357.4	2.28	-0.4	-0.4	0.48	100
5	18377	2.17	-0.48	-0.34	0.76	100
6	18396.8	1.2	-0.59	-0.52	0.49	100
7	18416.7	2	-0.1	-0.04	0.59	100
8	18436	1.2	0	-0.01	0.41	100
9	18436.6	2.49	0.51	0.29	1.41	100
10	18437.2	1.47	-0.58	-0.48	0.49	100
11	18438.7	30.72	-0.31	0.06	3.11	100
12	18439.4	1.5	-0.6	-0.65	2.09	100
13	18440	2.28	-0.1	-0.02	0.72	100
14	18456.6	2.7	-0.48	-1.04	1.75	100
	1 2 3 4 5 6 7 8 9 10 11 12	1 18298.9 2 18316.9 3 18339.9 4 18357.4 5 18377 6 18396.8 7 18416.7 8 18436 9 18436.6 10 18437.2 11 18438.7 12 18439.4 13 18440	1 18298.9 7.4 2 18316.9 5.79 3 18339.9 1.2 4 18357.4 2.28 5 18377 2.17 6 18396.8 1.2 7 18416.7 2 8 18436 1.2 9 18436.6 2.49 10 18437.2 1.47 11 18438.7 30.72 12 18439.4 1.5 13 18440 2.28	1 18298.9 7.4 0.28 2 18316.9 5.79 -0.2 3 18339.9 1.2 0 4 18357.4 2.28 -0.4 5 18377 2.17 -0.48 6 18396.8 1.2 -0.59 7 18416.7 2 -0.1 8 18436 1.2 0 9 18436.6 2.49 0.51 10 18437.2 1.47 -0.58 11 18438.7 30.72 -0.31 12 18439.4 1.5 -0.6 13 18440 2.28 -0.1	1 18298.9 7.4 0.28 0.5 2 18316.9 5.79 -0.2 -0.08 3 18339.9 1.2 0 0.05 4 18357.4 2.28 -0.4 -0.4 5 18377 2.17 -0.48 -0.34 6 18396.8 1.2 -0.59 -0.52 7 18416.7 2 -0.1 -0.04 8 18436 1.2 0 -0.01 9 18436.6 2.49 0.51 0.29 10 18437.2 1.47 -0.58 -0.48 11 18438.7 30.72 -0.31 0.06 12 18439.4 1.5 -0.6 -0.65 13 18440 2.28 -0.1 -0.02	1 18298.9 7.4 0.28 0.5 1.31 2 18316.9 5.79 -0.2 -0.08 1.15 3 18339.9 1.2 0 0.05 0.33 4 18357.4 2.28 -0.4 -0.4 0.48 5 18377 2.17 -0.48 -0.34 0.76 6 18396.8 1.2 -0.59 -0.52 0.49 7 18416.7 2 -0.1 -0.04 0.59 8 18436 1.2 0 -0.01 0.41 9 18436.6 2.49 0.51 0.29 1.41 10 18437.2 1.47 -0.58 -0.48 0.49 11 18438.7 30.72 -0.31 0.06 3.11 12 18439.4 1.5 -0.6 -0.65 2.09 13 18440 2.28 -0.1 -0.02 0.72





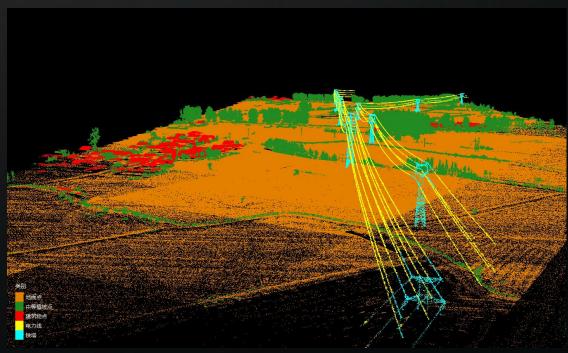
Topography and terrain conditions to know

low efficiency with TS and RTK

Aerial photogrammetry and LiDAR survey would be better

Recommended: airborne





06 Power Grids - power lines routing

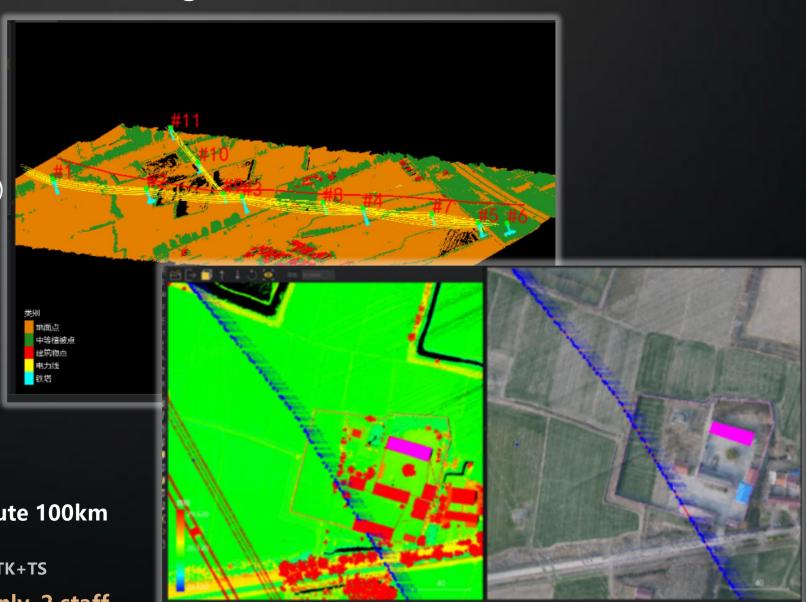


Al auto classification

(electric tower, power lines, buildings, vegetation, bare ground)

Auto extraction based on slope features

Features extraction based on DOM



Job Case: one electricity design insititute 100km routing survey

- Before: fieldwork + process 14 days, 7 staff, RTK+TS
- Now: fieldwork + process 5 days only, 2 staff



