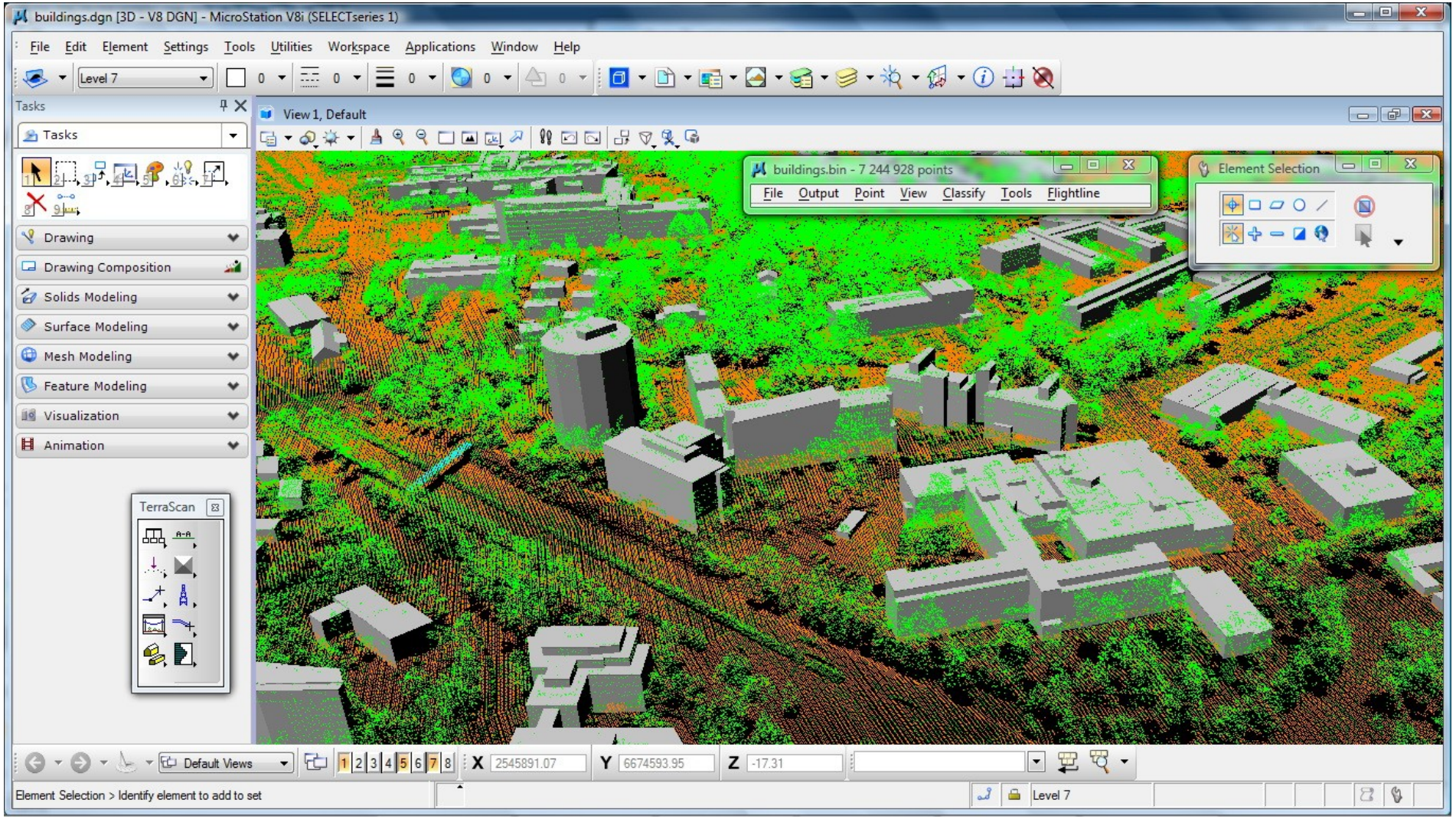


Terrasolid Ltd.

Software for LiDAR processing

Terrasolid

Terrasolid

Mika Salolahti

Business Development Manager

Mobile: +358 500 445 179
E-mail: mika.salolahti@terrasolid.fi

Kanavaranta 7 B 28 FIN-00160 Helsinki Finland

www.terrasolid.fi

Terrasolid Ltd.

- Founded in 1989
- 21+ years of software development on MicroStation
- 10+ years of point cloud software development
- Last fiscal year revenues 3,5 M€
- Customers in 90+ countries
- Over 2500 TerraScan licenses sold
- Global market leader in airborne and mobile laser scanned point cloud processing
- Based in Finland

Terrasolid products

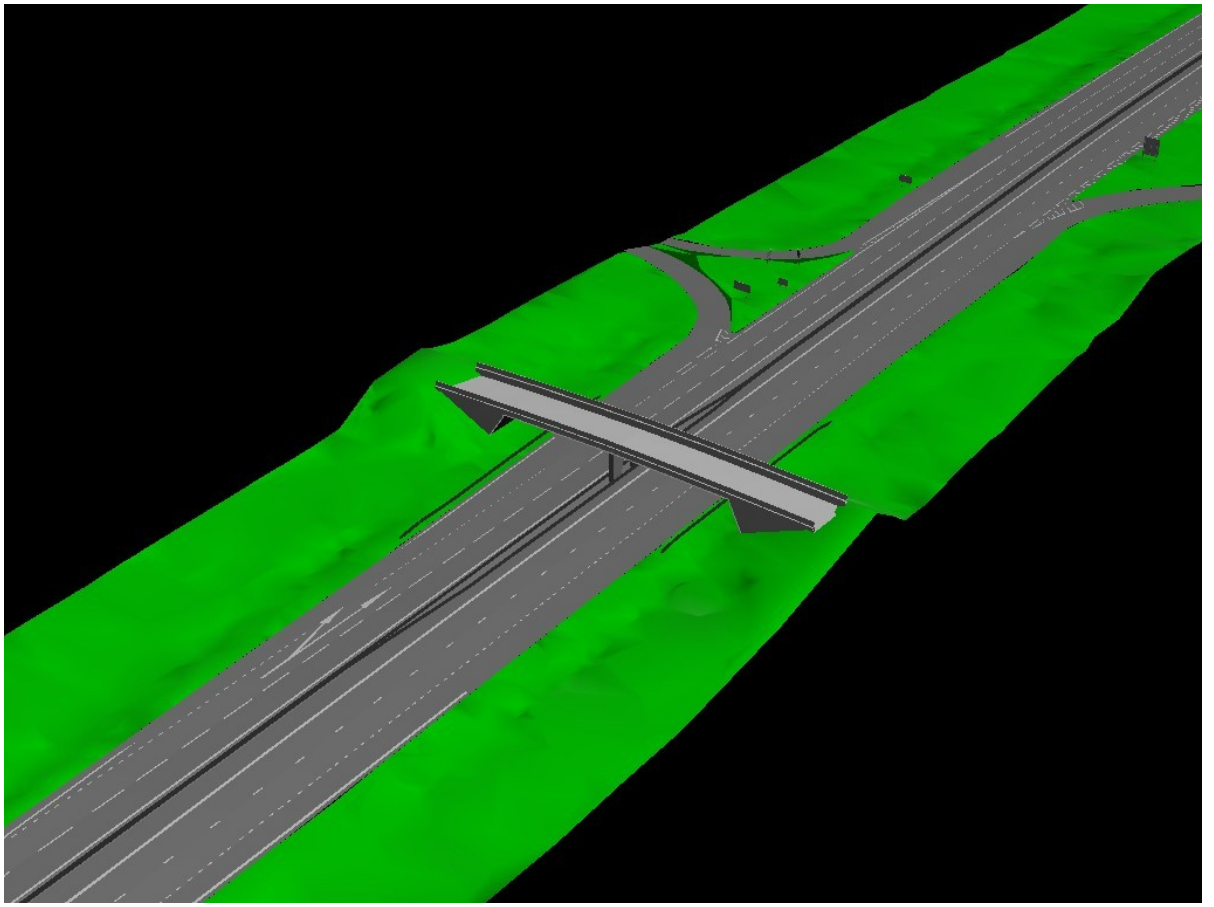
LiDAR processing

- TerraScan
- TerraMatch
- TerraPhoto
- TerraModeler
- TerraSurvey

Terrasolid products

Infrastructure design

- TerraStreet
- TerraPipe
- TerraGas
- TerraHeat
- TerraBore



Platforms

- MicroStation V8i or V8 2004 Edition
- Bentley Map
- Bentley Map PowerView
- Bentley PowerCivil

展商名录（排名不按顺序）

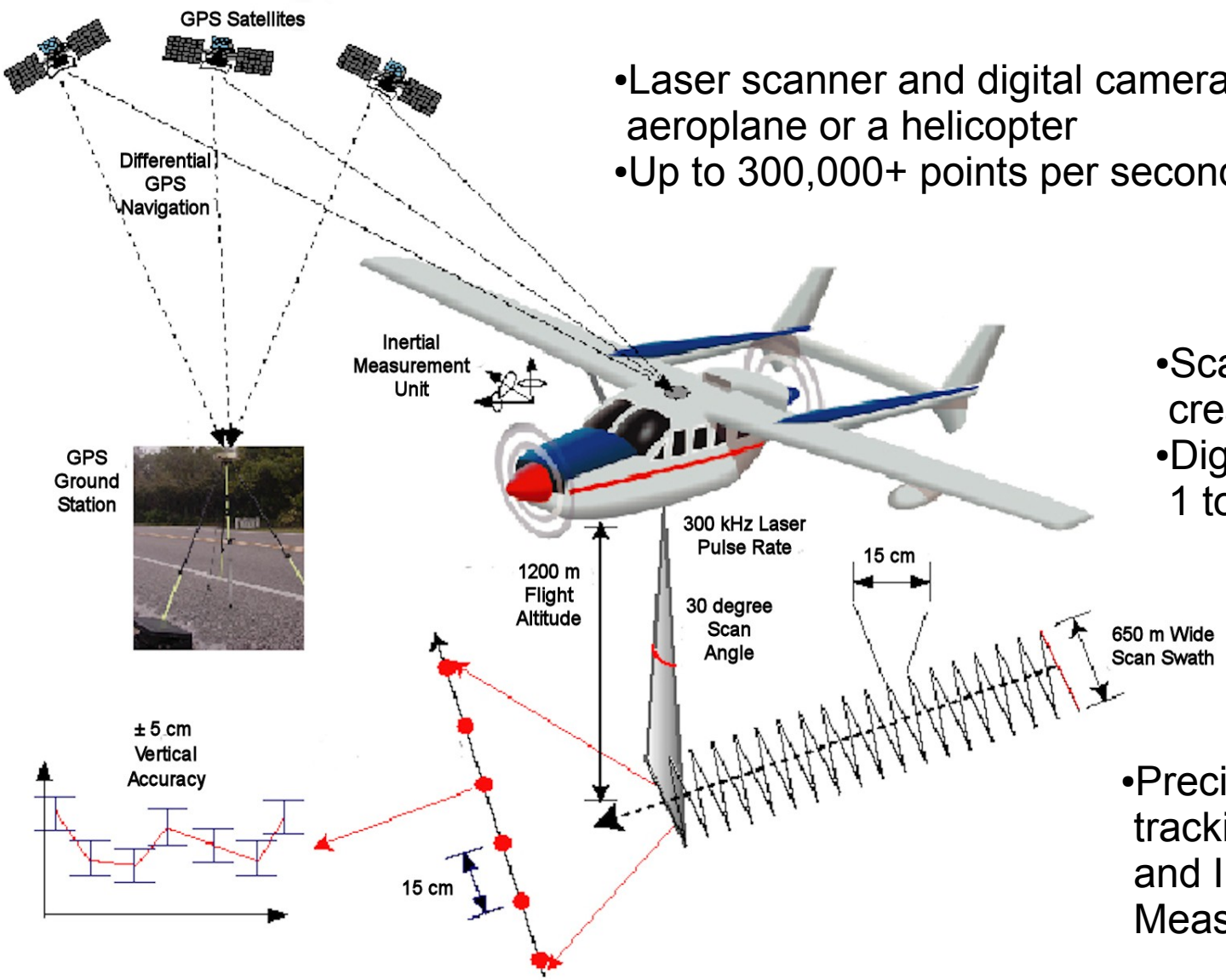
展商名称	展位号	展商名称	展位号	支持媒体	展位号
北京市东城区人民政府	B02	北京中软强网信息技术有限公司	B06	中国建设报	F020
ESRI中国(北京)有限公司	B02	芬兰Terrasolid公司	F023	《建设科技》杂志	F007
北京数字政通科技股份有限公司	B02	中国惠普有限公司	E100/E101	《智能建筑》杂志	F021
中国移动通信集团公司	B02	西安大奥信息科技有限公司	E093	《3S世界》杂志	F015
中国联合网络通信有限公司	A08	上海迅图数码科技有限公司	F028	《智能交通》杂志	F016
中国电信集团公司	D07	松原市人民政府宣	E094	中国物流产品网	F009
北京华美博弈软件开发有限公司	B01	北京同创艺彩数码图像技术有限公司	E102	千家网	F014
北京水晶石数字科技有限公司	D06	北京国遥新天地信息技术有限公司	E089/E090	国际数字地球学会《国际数字地球学报》	F011
易建科技有限公司	C07-2	广州城市信息研究所有限公司	E096	中国知识	F003
北京超图软件股份有限公司	A09-1	广东南方数码科技有限公司	F013	中国国土	F008
中南集团控股有限公司	B04-1	广州奥格智能科技有限公司	F012	搜狐焦点	F029/030
北京通世舟数字科技有限责任公司	D04	北京思亿达科贸有限公司	E099	《数字城市 国建设信息》	E087/E088
深圳市中视典数字科技有限公司	C01	北京伟景行数字城市科技有限公司	F017/F018	新地	F002
北京海澄华图科技有限公司	C02	杭州阿拉丁信息科技股份有限公司	E095	国	F010
北京建设数字科技股份有限公司	A03	深圳市斯维尔科技有限公司	F019	天	F001
中地数码集团	A06	北京天地适图科技有限公司	E097		
北京东方道迩信息技术有限责任公司	A05	北京时代凌宇科技有限公司	F022		
立得空间信息技术有限公司	B03/B05	中国工程建设行业软件产业联合体			
金鹏电子信息机器有限公司	C07-1	(中国BLM联盟)	F024/F025/		
武汉市国土资源和规划局	C03	北京慧点科技开发有限公司	E091/E092		
天津滨海激光雷达技术产业有限公司	C09	北京炫色科技发展有限公司	E098		
麦格集团	B04-2	北京星天地信息科技有限公司	A02		

数字东城
东城区网格化城市管理新模式成功运行5周年
易至居 etdom
中国移动通信 CHINA MOBILE
易建
中地数码 ZONDY CYBER
eGOV
水晶石 CRYSTAL CG
ESRI Chin Geographic Thinking
搜狐焦点 WWW.FOCUS.CN

Laser scanning

- Terrestial
  - Static tripod
- Airborne
  - Aeroplane
  - Helicopter
- Mobile
  - Car
  - Train

Airborne LiDAR principles



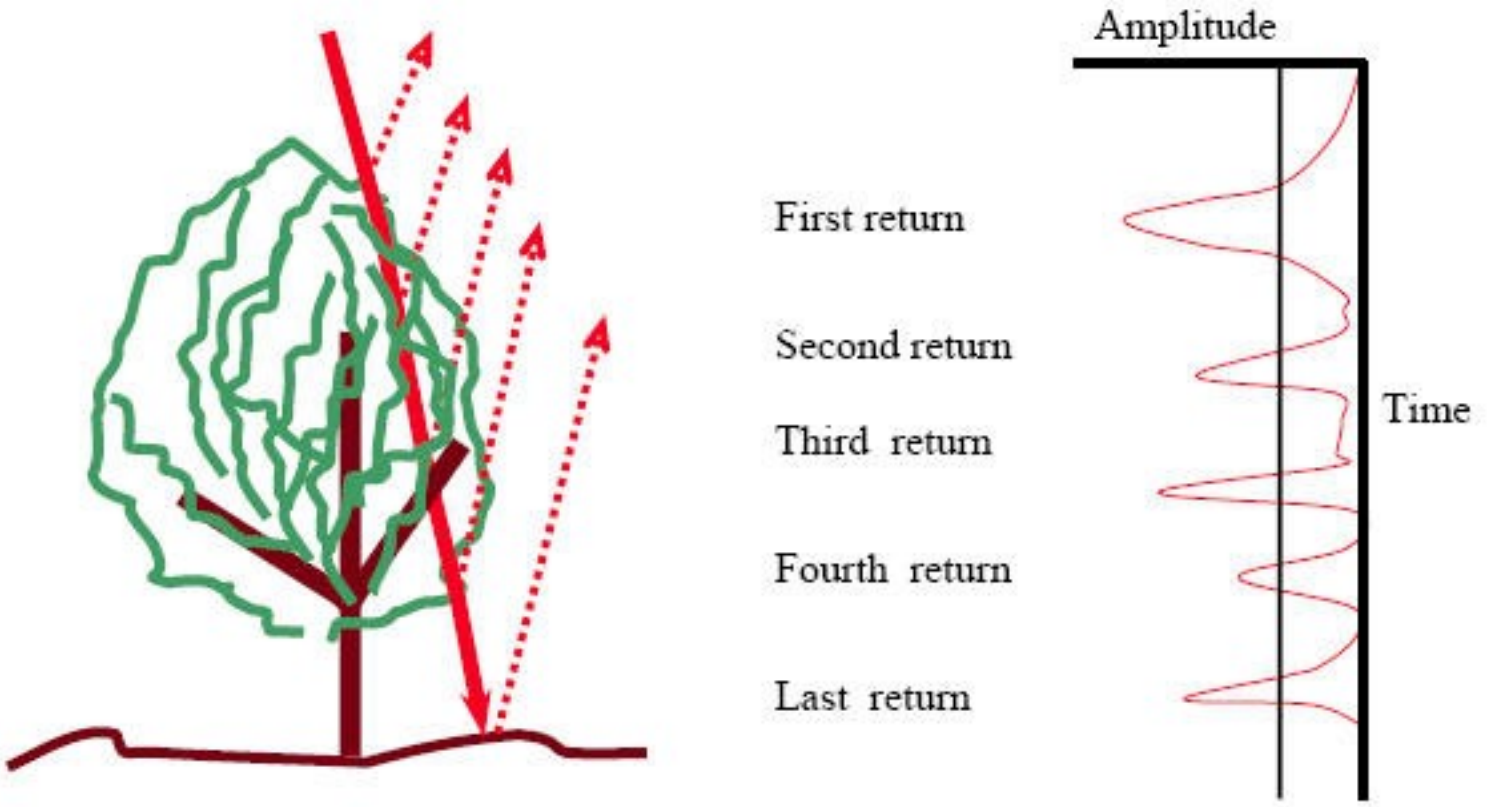
- Laser scanner and digital camera mounted into an aeroplane or a helicopter
- Up to 300,000+ points per second

- Scanner mirror rotates to create a scanning pattern
- Digital photographs every 1 to 3 seconds

- Precise location and position tracking with differential GPS and IMU (Inertial Measurement Unit)

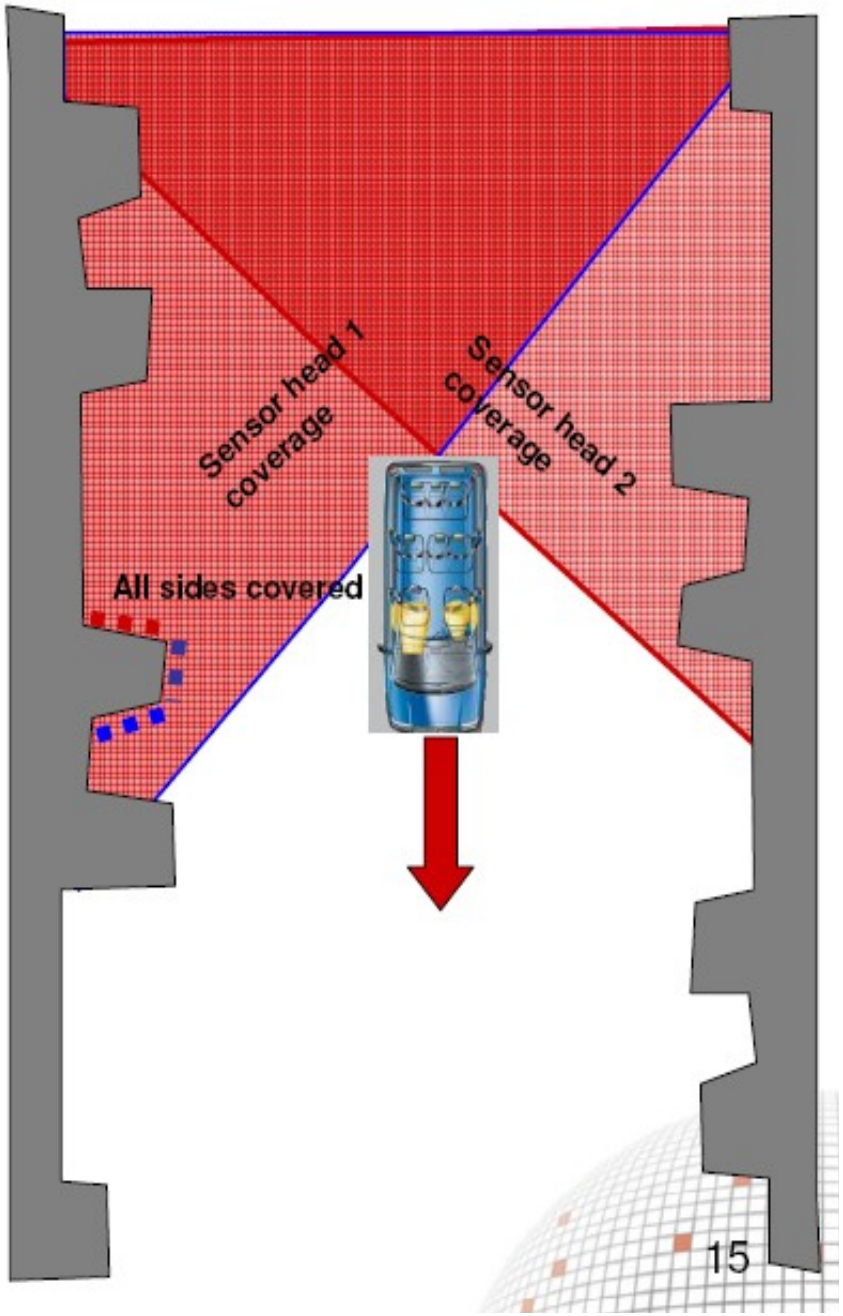
Terrasolid

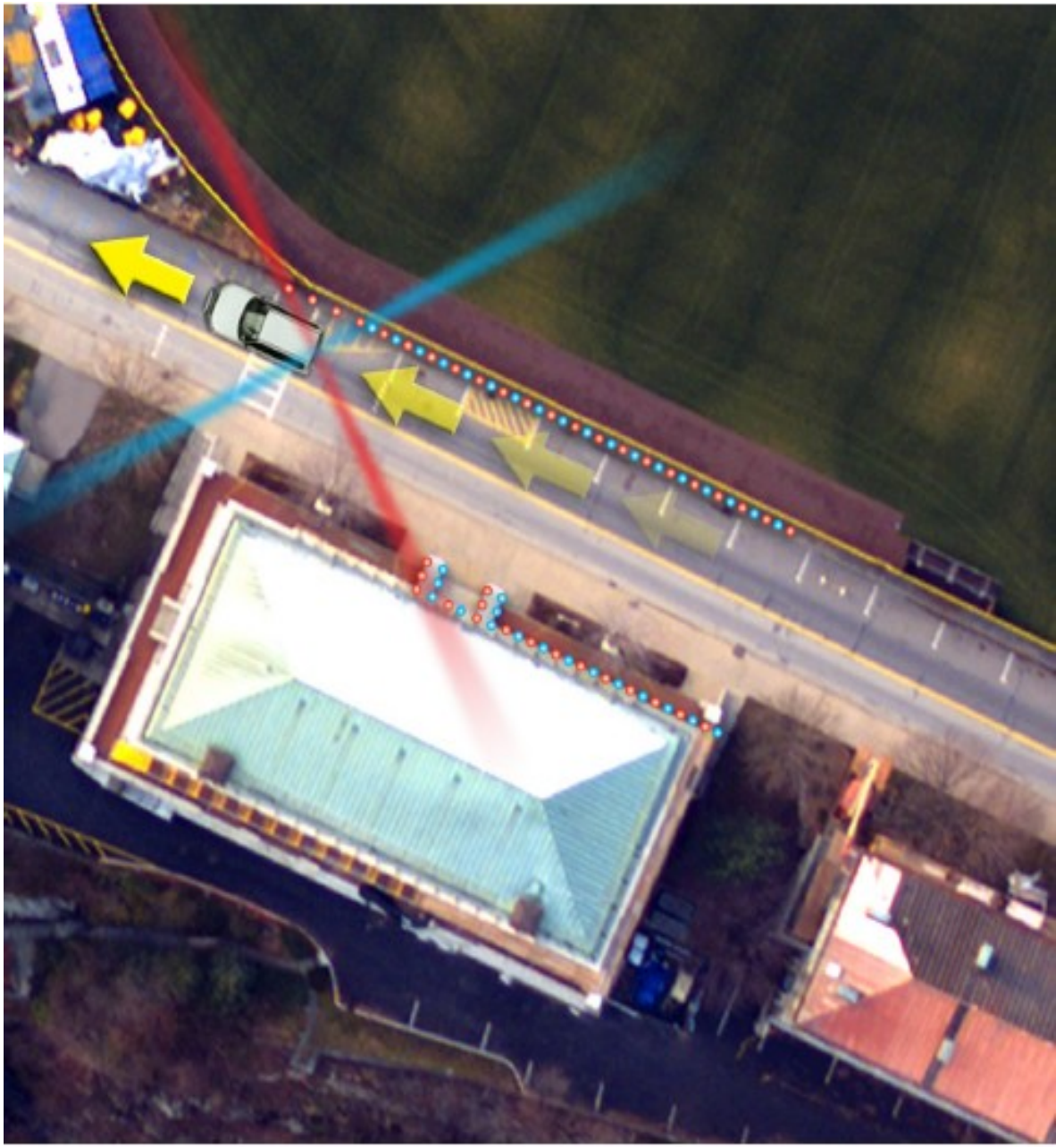
Multiple echos & full waveform



Mobile laser scanning

- 3D Laser Mapping – StreetMapper
- Optech – Lynx
- Riegl - VMX-250
- Mitshubishi
- Topcon


Sensor head 1 coverage
Sensor head 2 coverage
All sides covered

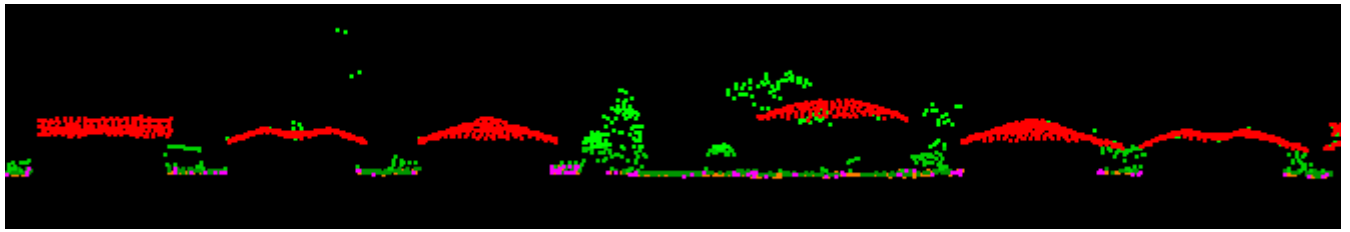


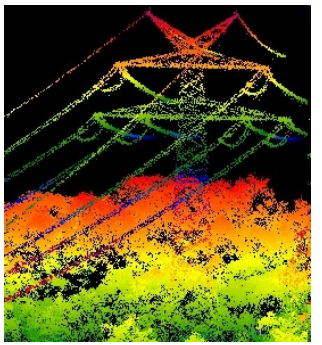
Terrasolid

Terrasolid

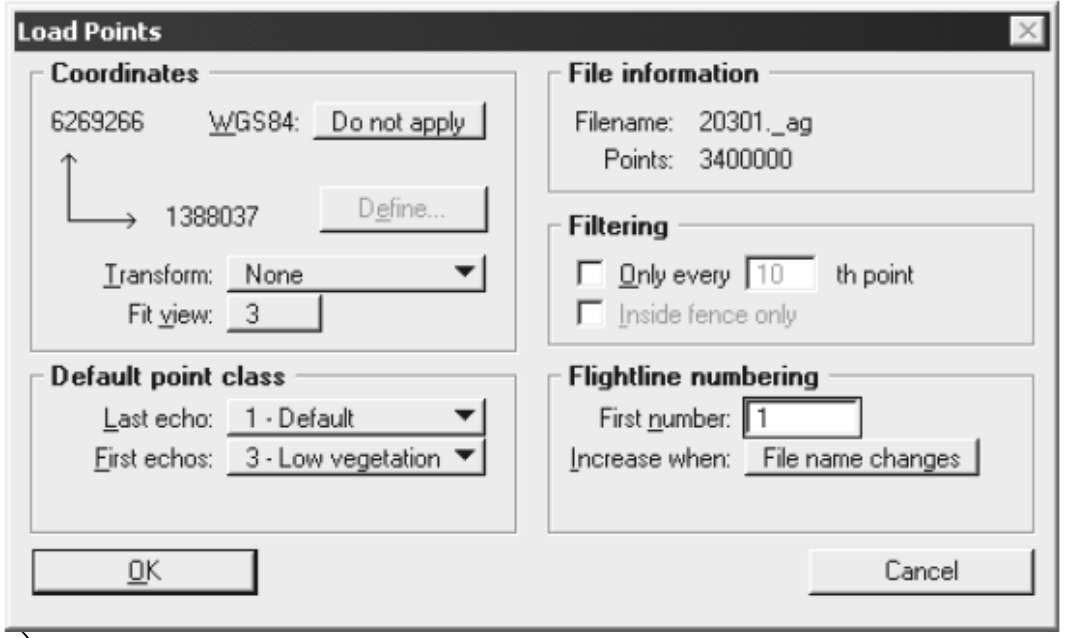
What do you do with Terrasolid's applications?

- After the flight or drive the point clouds are pre-processed with the hardware vendors specific application
- After that the point clouds are calibrated and the precisioon is improved with Terra applications





Process



Import RAW laser data and trajectories

Calibrate and align point clouds from multiple flightlines

Classify the points with rules

Process airborne images and produce orthos

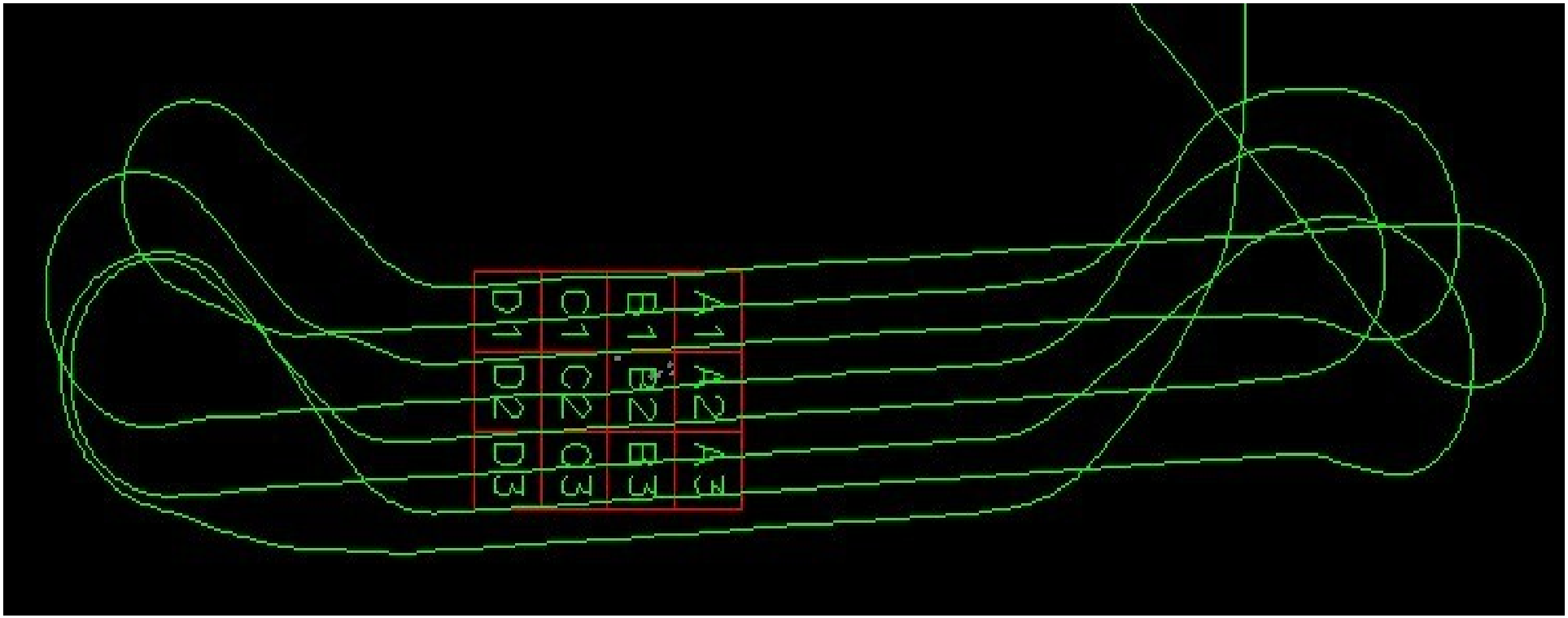
Produce delivery products

Surface models with breaklines
Accurate 3D road and bridge models for design purposes
Contours
Building models
True orthos
Digitized transmission power lines for efficiency calculations
Digitized transmission lines for vegetation maintenance
Flood models
etc…

Terrasolid

TerraScan

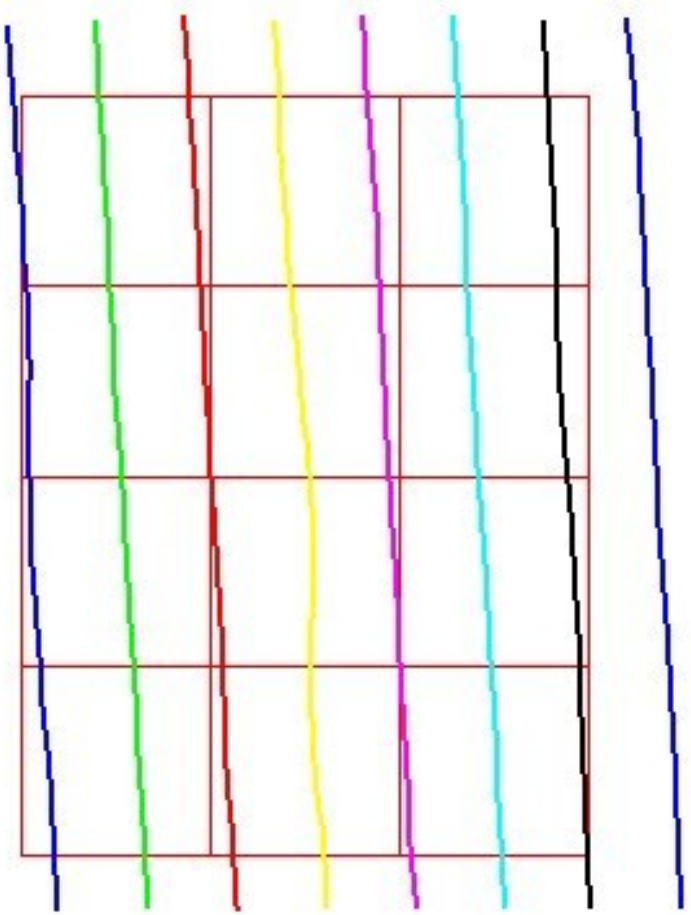
- Read the points into the correct coordinate system
- Divide the points into blocks

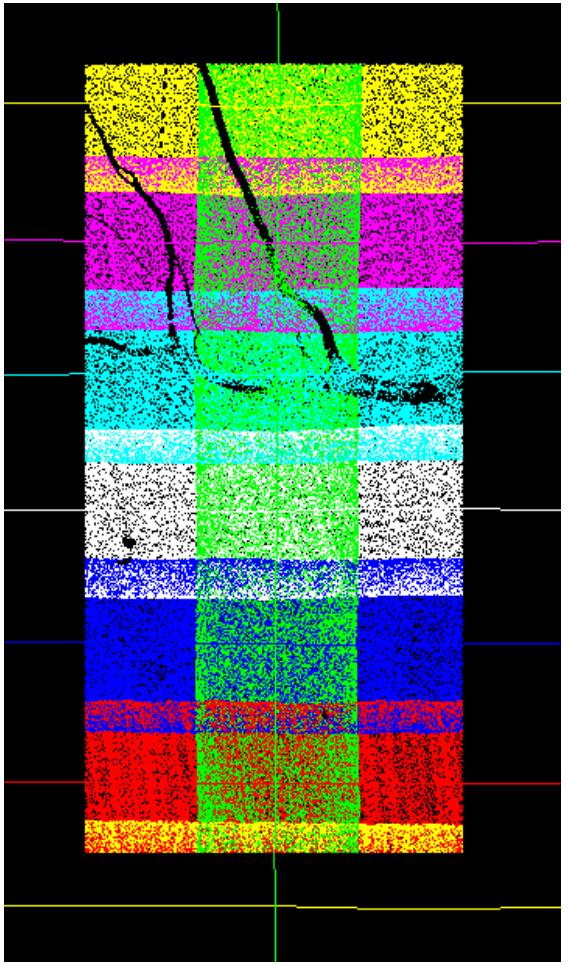


Terrasolid

TerraScan

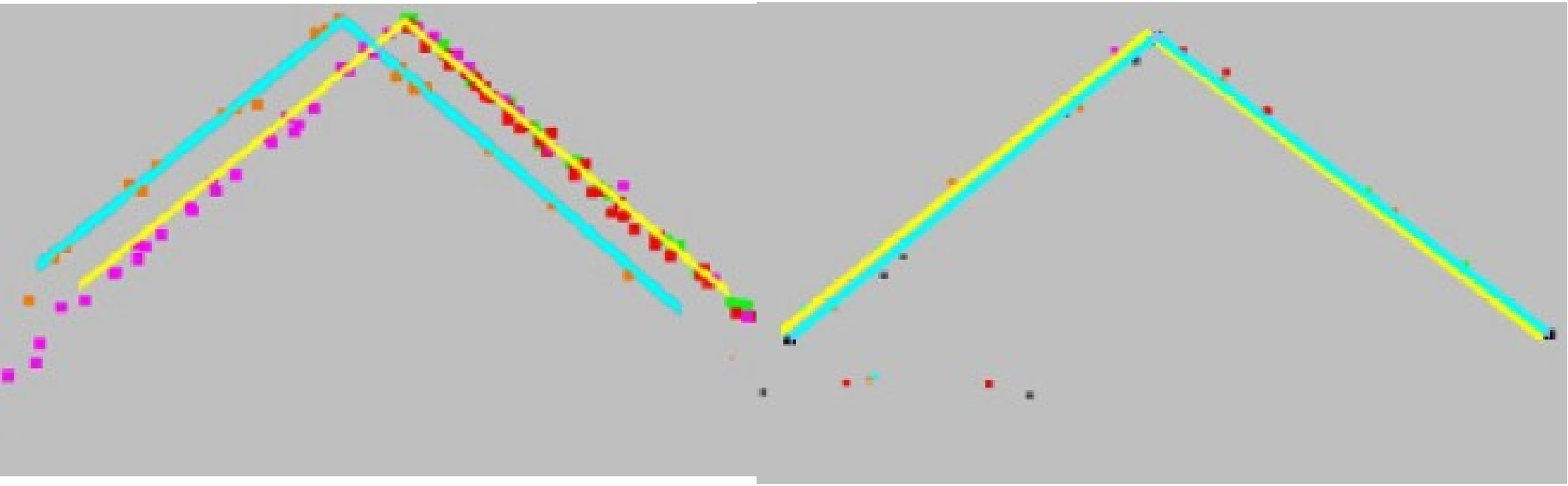
- Classify the points by flightline





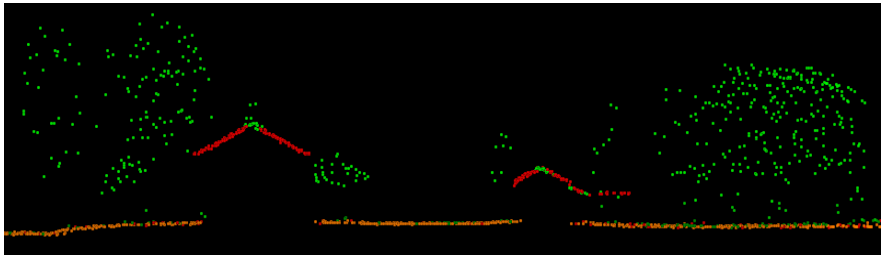
TerraMatch

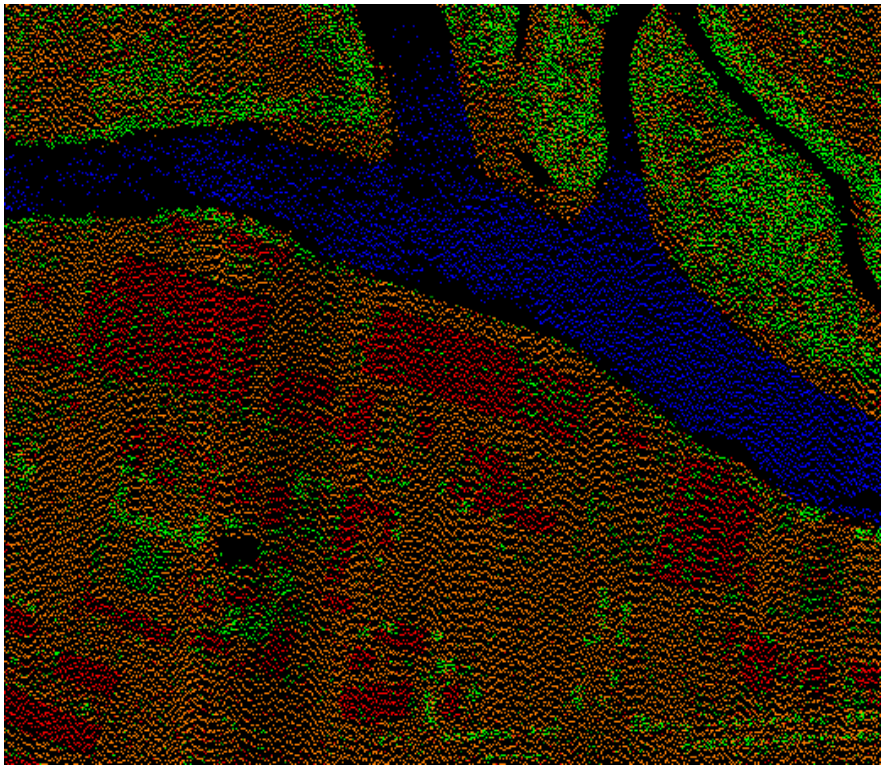
- Match the multiple flight passess by tie lines



TerraScan

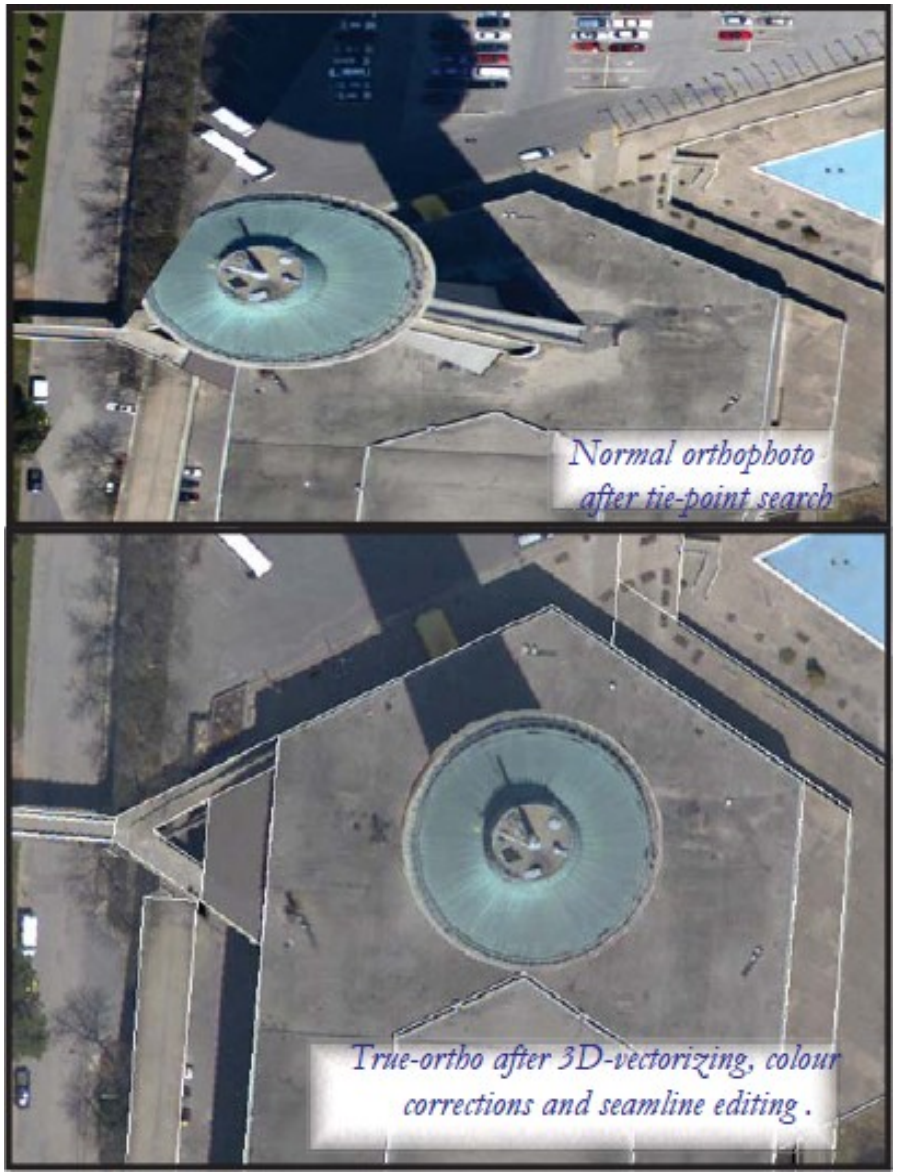
- Point classification
  - Ground
  - Vegetation by height from ground
  - Buildings
  - Model keypoints
- Manual editing





TerraPhoto

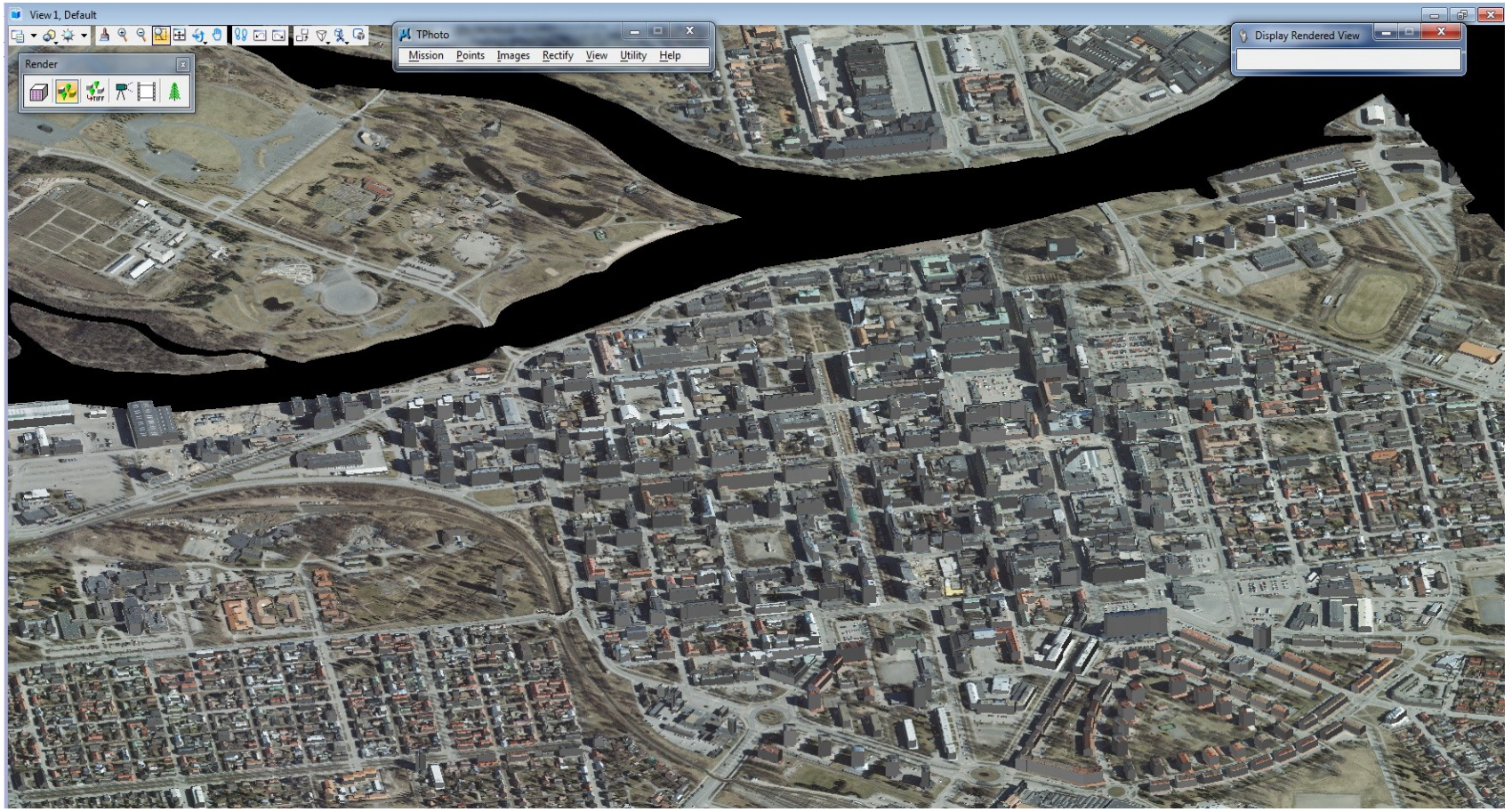
- TrueOrtho-production
- Supports the point classification process
- We have the ground model from LiDAR points
- We have the building roofs through automatic vectorization



Terrasolid

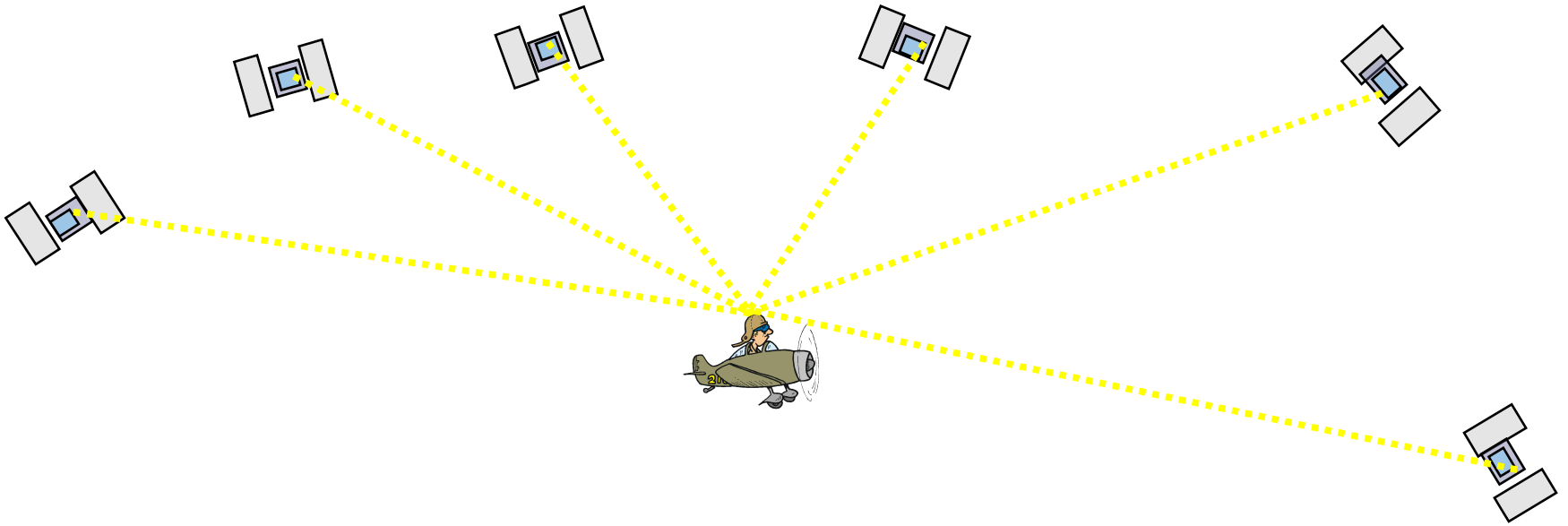
TerraPhoto

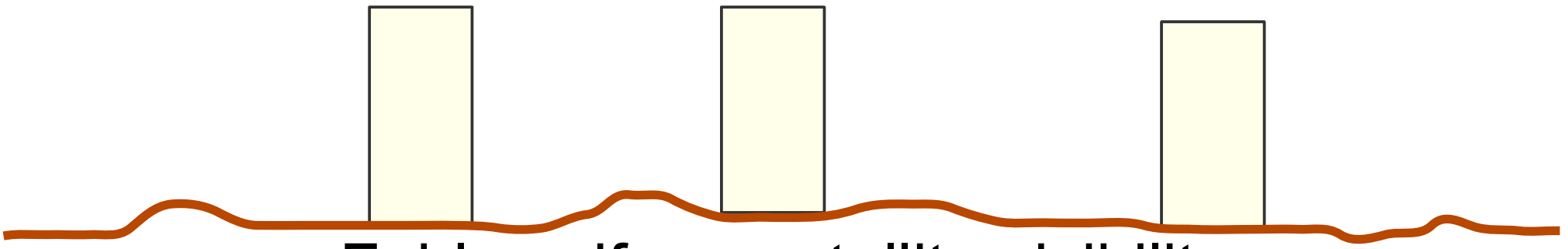
- Draping an ortho on to the ground



Terrasolid

Airborne Positioning





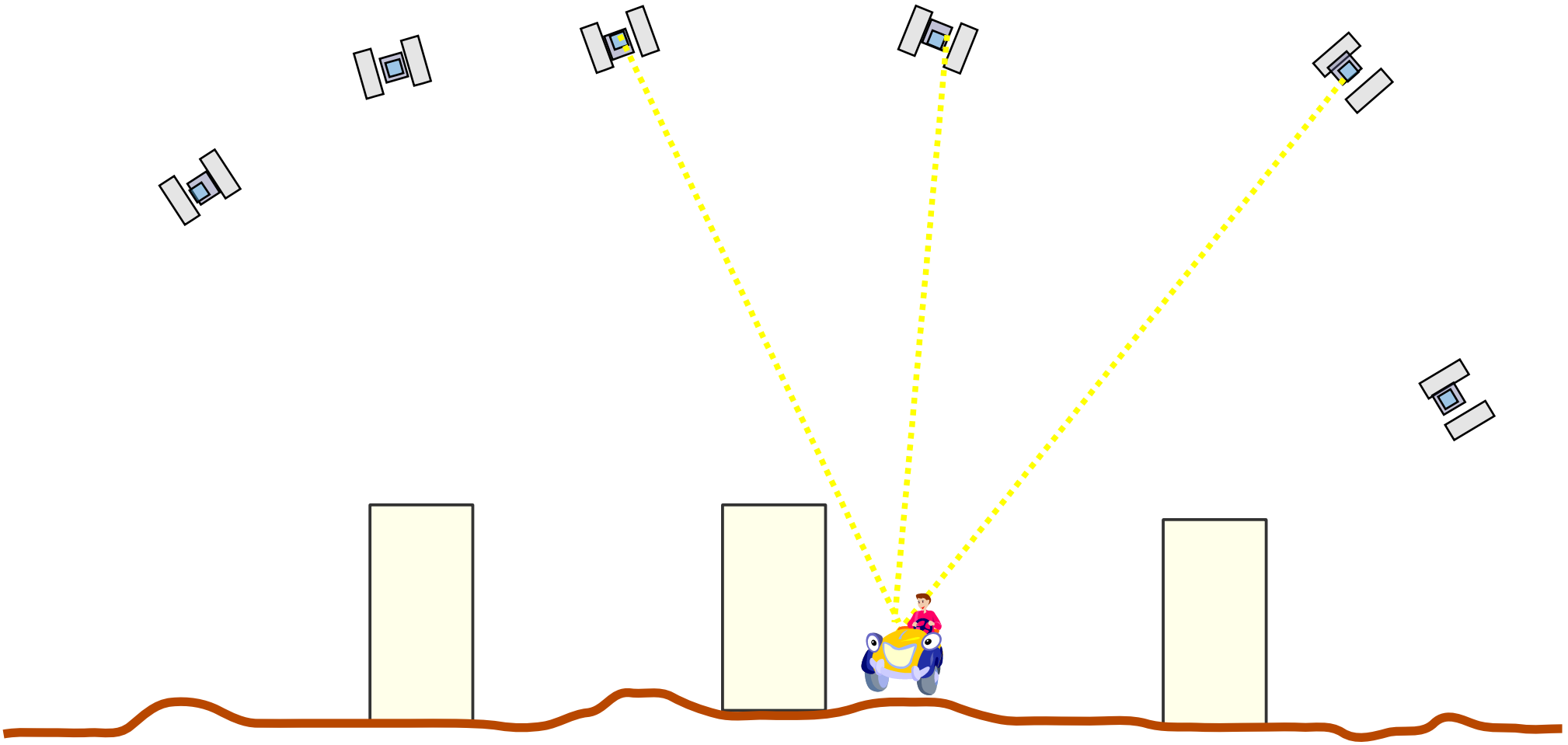
Fairly uniform satellite visibility

Fairly uniform positional accuracy

Terrasolid

Terrasolid

Mobile Trajectory Solution



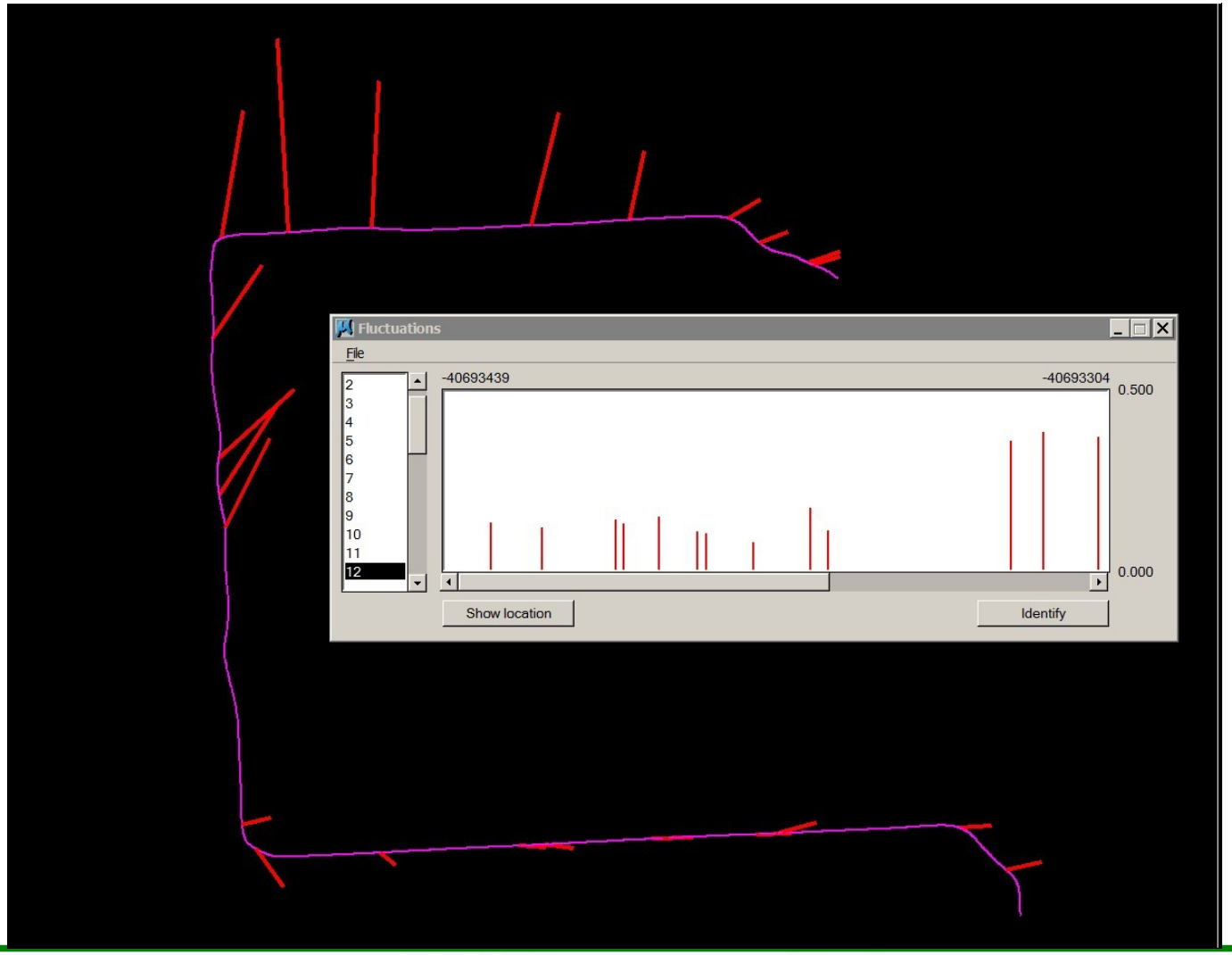
Satellite visibility varies

Positioning accuracy varies

Terrasolid

Fluctuating Corrections

- Xy correction vectors for drive pass in difficult city environment



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Airborne vs Mobile

- Good satellite visibility
- Consistent positioning
- Free design for flight pattern
- Not many surprises
- Consistent point density

- Sees objects from above
- Less details: mapping level
- Fairly consistent light conditions for images

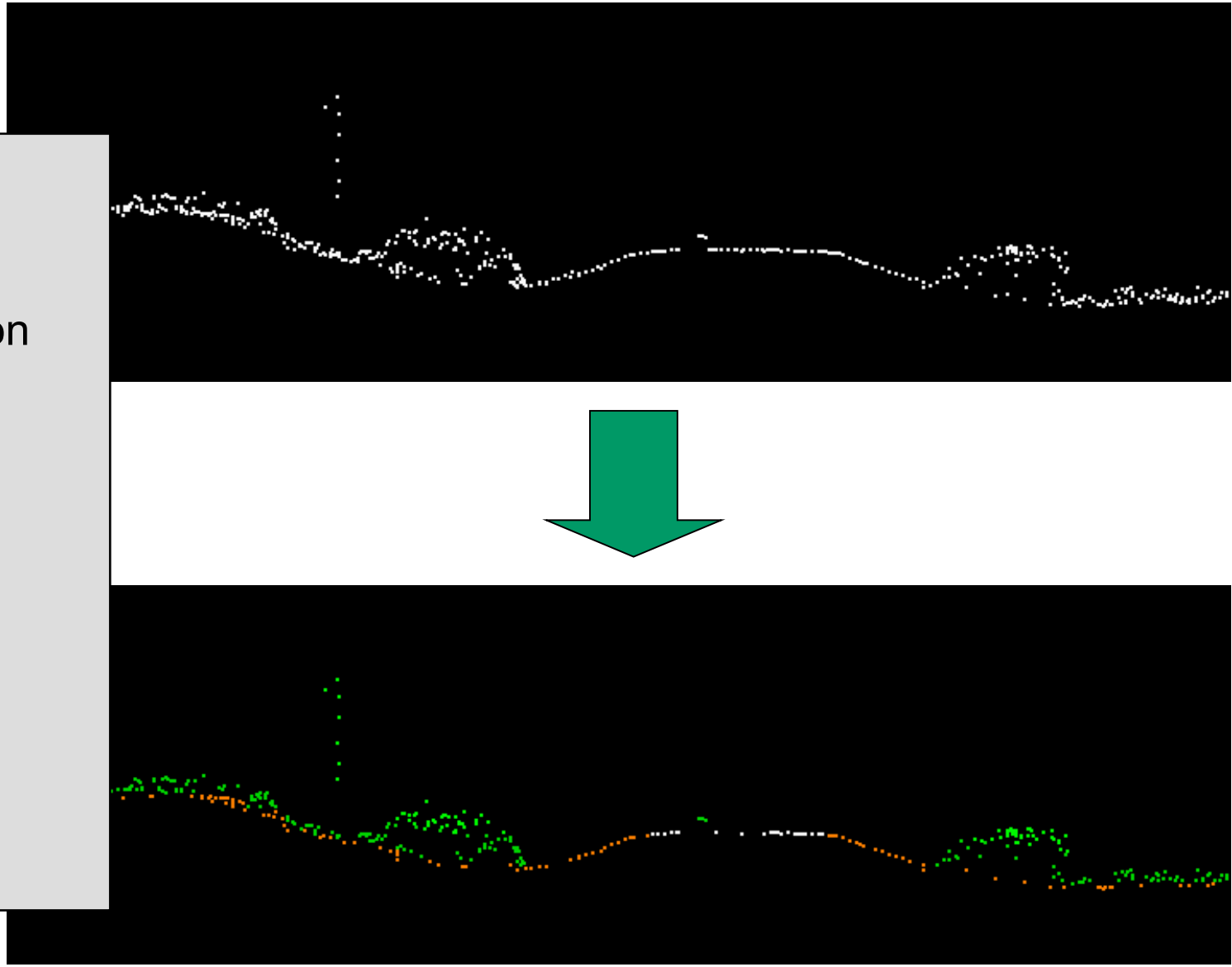
- Varying satellite visibility
- Accuracy varies
- Has to follow the road network
- Suprises: road work, traffic...
- High density on the road
- Low density off from the road

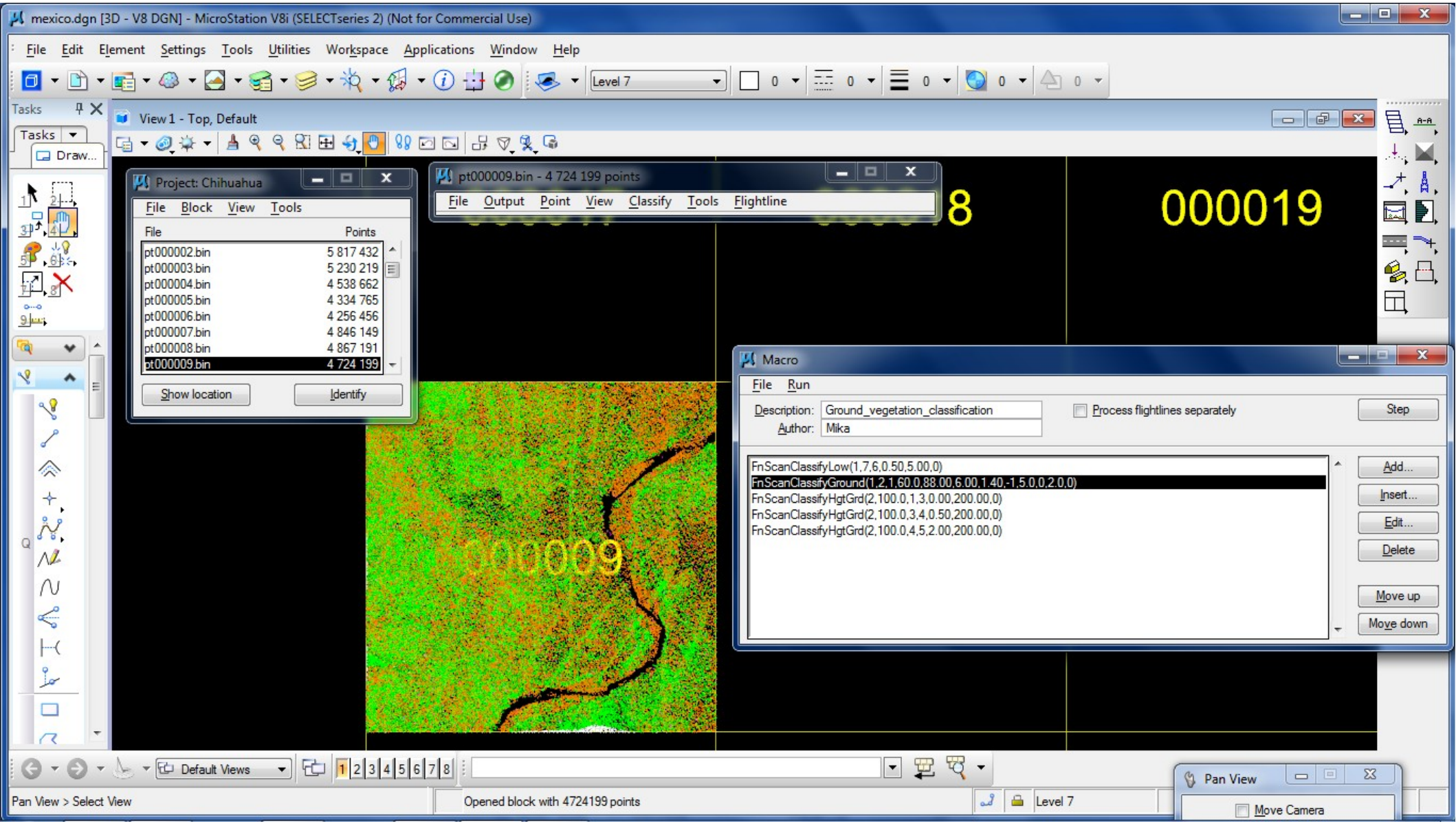
- Sees object from all directions
- More details: engineering level
- Light conditions vary all the time: dark/bright images

Point classification

- Automatic and manual routines

1	Default
2	Ground
3	Low vegetation
4	Medium vegetation
5	High vegetation
6	Building
7	Low point
8	Model keypoints
9	Vector building
10	Bridge
11	Wire
12	Tree
13	Breakline ground

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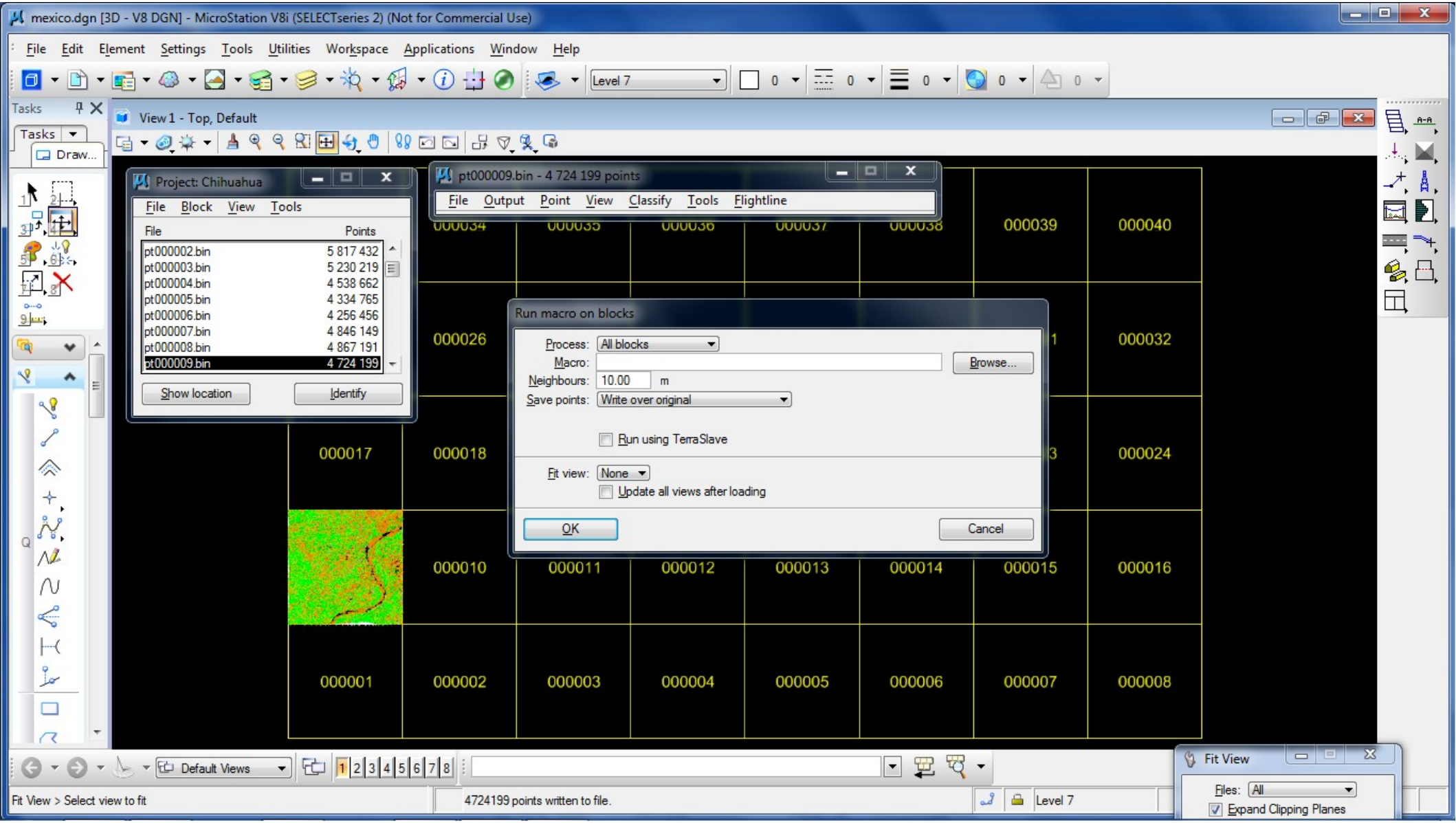
File Edit Element Settings Tools Utilities Workspace Applications Window Help
Level 7
Tasks
Draw...
View 1 - Top, Default
Project: Chihuahua
File Block View Tools
File Points
pt000002.bin 5 817 432
pt000003.bin 5 230 219
pt000004.bin 4 538 662
pt000005.bin 4 334 765
pt000006.bin 4 256 456
pt000007.bin 4 846 149
pt000008.bin 4 867 191
pt000009.bin 4 724 199
Show location
Identify
pt000009.bin - 4 724 199 points
File Output Point View Classify Tools Flightline
000019
Macro
File Run
Description: Ground_vegetation_classification
Author: Mika
Process flightlines separately
Step
FnScanClassifyLow(1,7,6,0.50,5.00,0)
FnScanClassifyGround(1,2,1,60.0,88.00,6.00,1.40,-1.5,0.0,2.0,0)
FnScanClassifyHgtGrd(2,100.0,1,3,0.00,200.00,0)
FnScanClassifyHgtGrd(2,100.0,3,4,0.50,200.00,0)
FnScanClassifyHgtGrd(2,100.0,4,5,2.00,200.00,0)
Add...
Insert...
Edit...
Delete
Move up
Move down
Default Views
Pan View
Move Camera
Pan View > Select View
Opened block with 4724199 points
Level 7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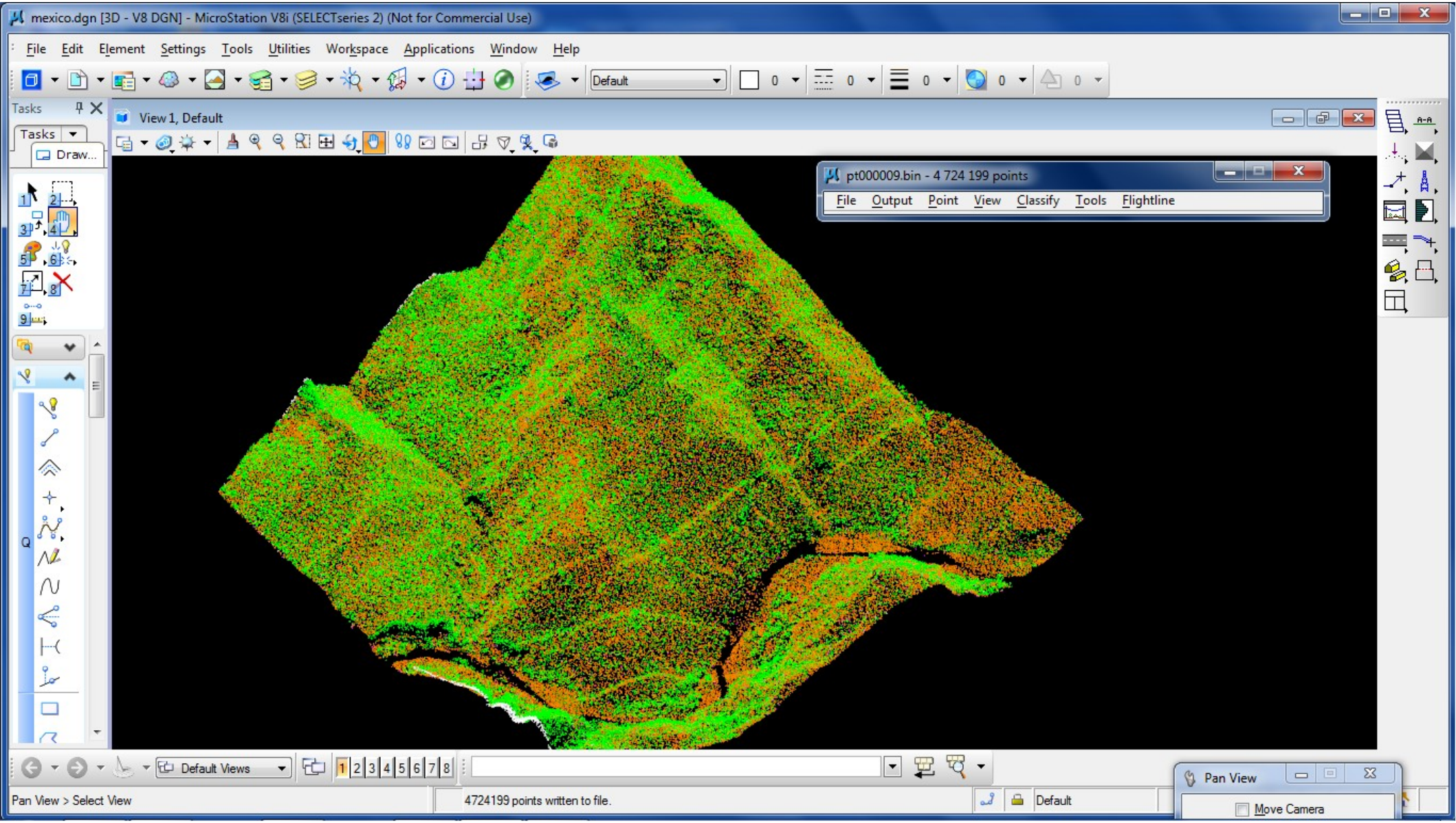
File Edit Element Settings Tools Utilities Workspace Applications Window Help
Level 7
Tasks
View 1 - Top, Default
Project: Chihuahua
File Block View Tools
File Points
pt000002.bin 5 817 432
pt000003.bin 5 230 219
pt000004.bin 4 538 662
pt000005.bin 4 334 765
pt000006.bin 4 256 456
pt000007.bin 4 846 149
pt000008.bin 4 867 191
pt000009.bin 4 724 199
Show location
Identify
pt000009.bin - 4 724 199 points
File Output Point View Classify Tools Flightline
Run macro on blocks
Process: All blocks
Macro:
Browse...
Neighbours: 10.00 m
Save points: Write over original
Run using TerraSlave
Fit view: None
Update all views after loading
OK
Cancel
000034 000035 000036 000037 000038 000039 000040
000026 000032
000017 000018 000024
000010 000011 000012 000013 000014 000015 000016
000001 000002 000003 000004 000005 000006 000007 000008
Default Views
Fit View > Select view to fit
4724199 points written to file.
Level 7
Fit View
Files: All
Expand Clipping Planes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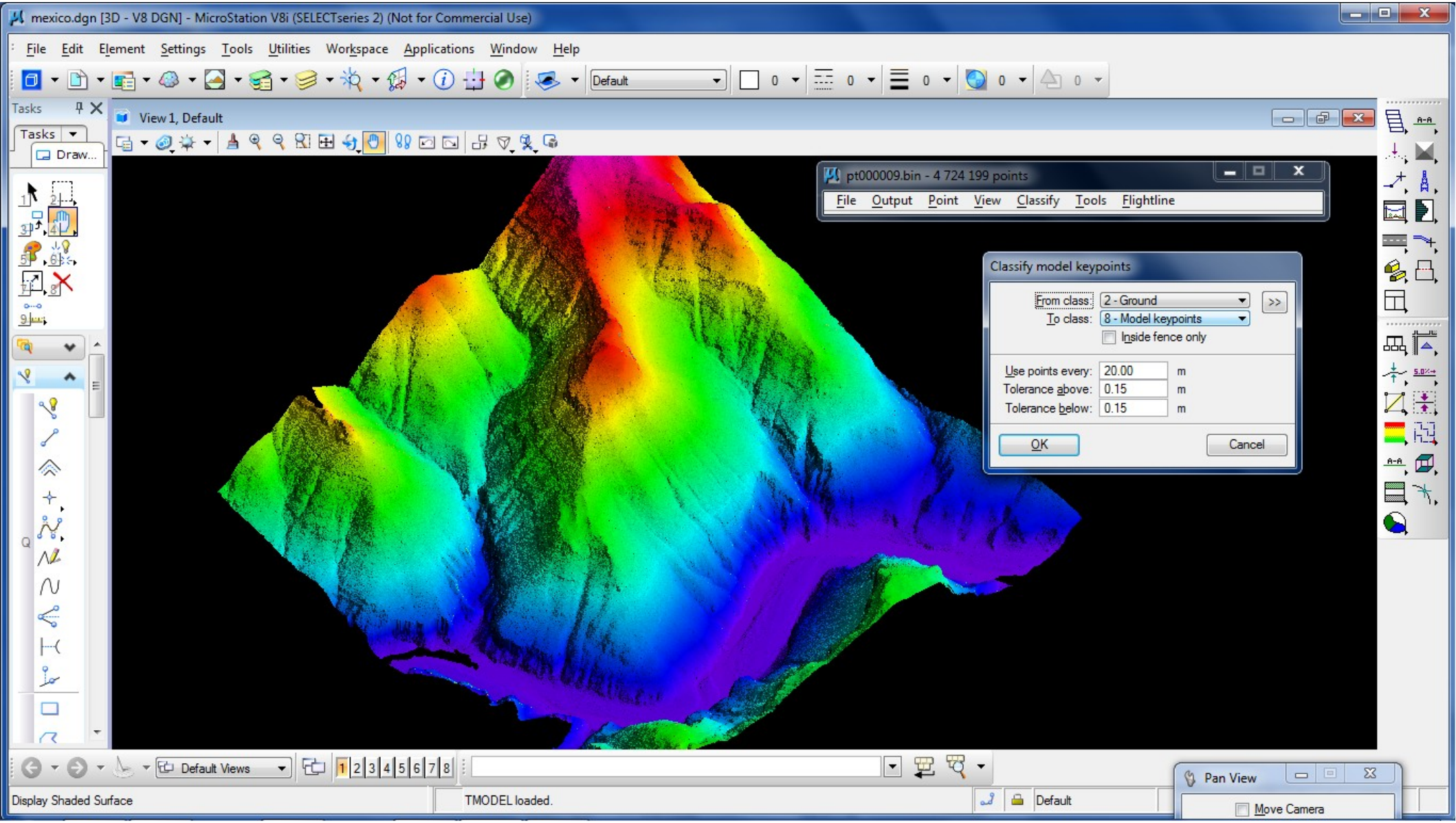
File Edit Element Settings Tools Utilities Workspace Applications Window Help
Default
Tasks
Tasks
Draw...
View 1, Default
pt000009.bin - 4 724 199 points
File Output Point View Classify Tools Flightline
Default Views
1 2 3 4 5 6 7 8
Pan View > Select View
4724199 points written to file.
Default
Pan View
Move Camera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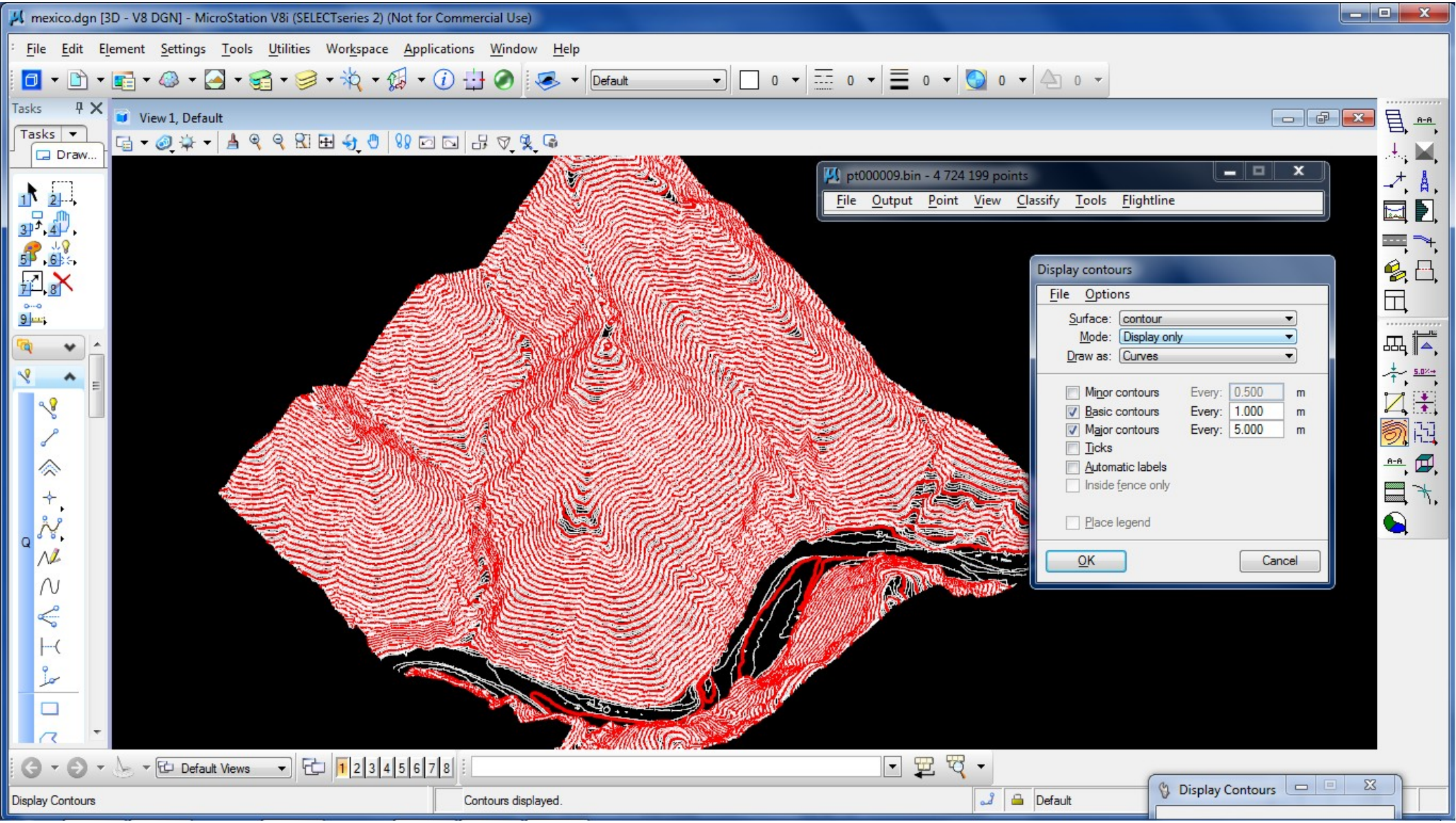
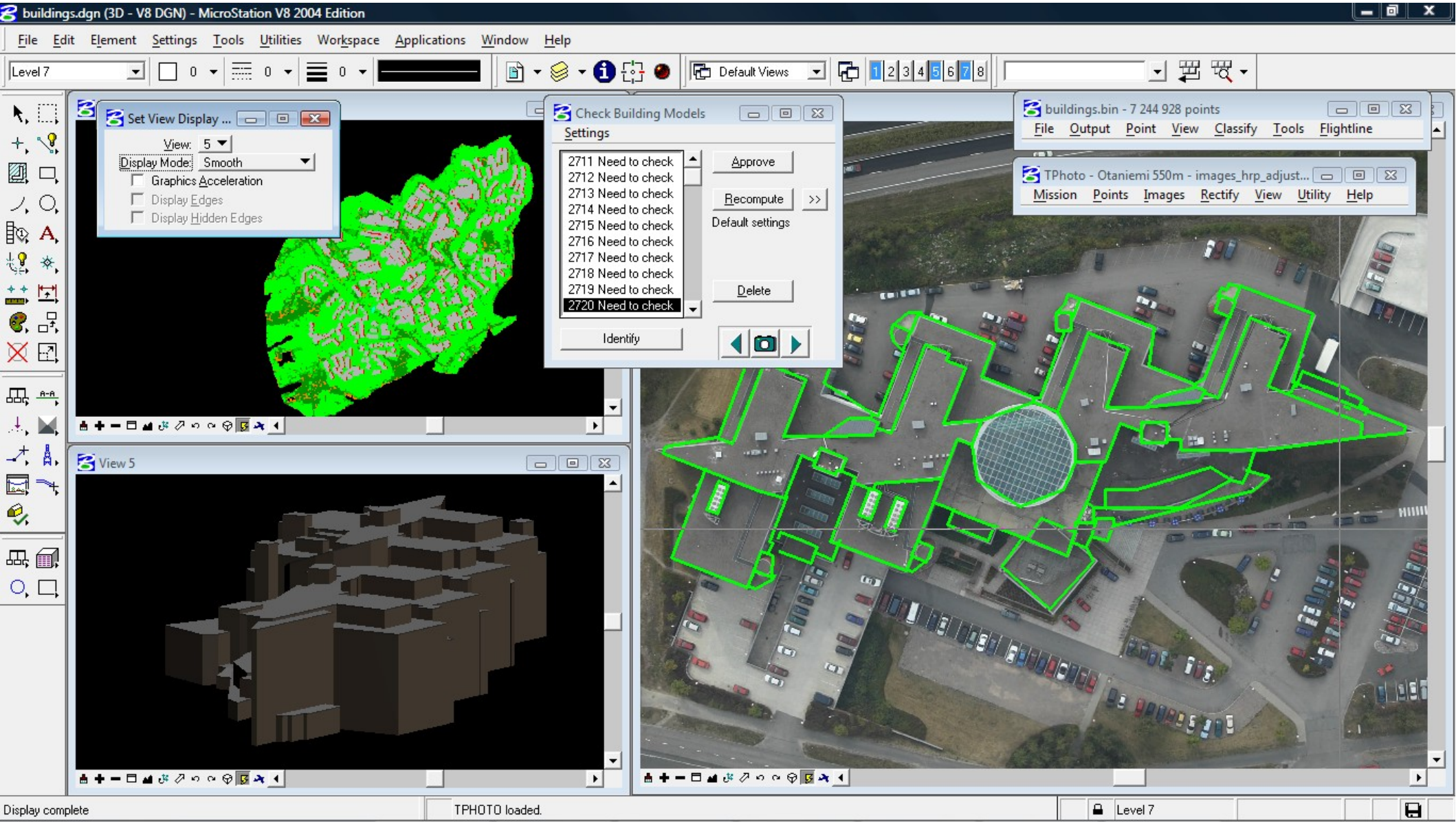
File Edit Element Settings Tools Utilities Workspace Applications Window Help
Default
Tasks
Draw...
View 1, Default
pt000009.bin - 4 724 199 points
File Output Point View Classify Tools Flightline
Classify model keypoints
From class: 2 - Ground
To class: 8 - Model keypoints
Inside fence only
Use points every: 20.00 m
Tolerance above: 0.15 m
Tolerance below: 0.15 m
OK
Cancel
Default Views
Pan View
Move Camera
Display Shaded Surface
TMODEL loaded.
Default


mexico.dgn [3D - V8 DGN] - MicroStation V8i (SELECTseries 2) (Not for Commercial Use)
File Edit Element Settings Tools Utilities Workspace Applications Window Help
Default
Tasks
Draw...
View 1, Default
pt000009.bin - 4 724 199 points
File Output Point View Classify Tools Flightline
Display contours
File Options
Surface: contour
Mode: Display only
Draw as: Curves
Minor contours Every: 0.500 m
Basic contours Every: 1.000 m
Major contours Every: 5.000 m
Ticks
Automatic labels
Inside fence only
Place legend
OK
Cancel
Default Views
Display Contours
Contours displayed.
Default
Display Contours

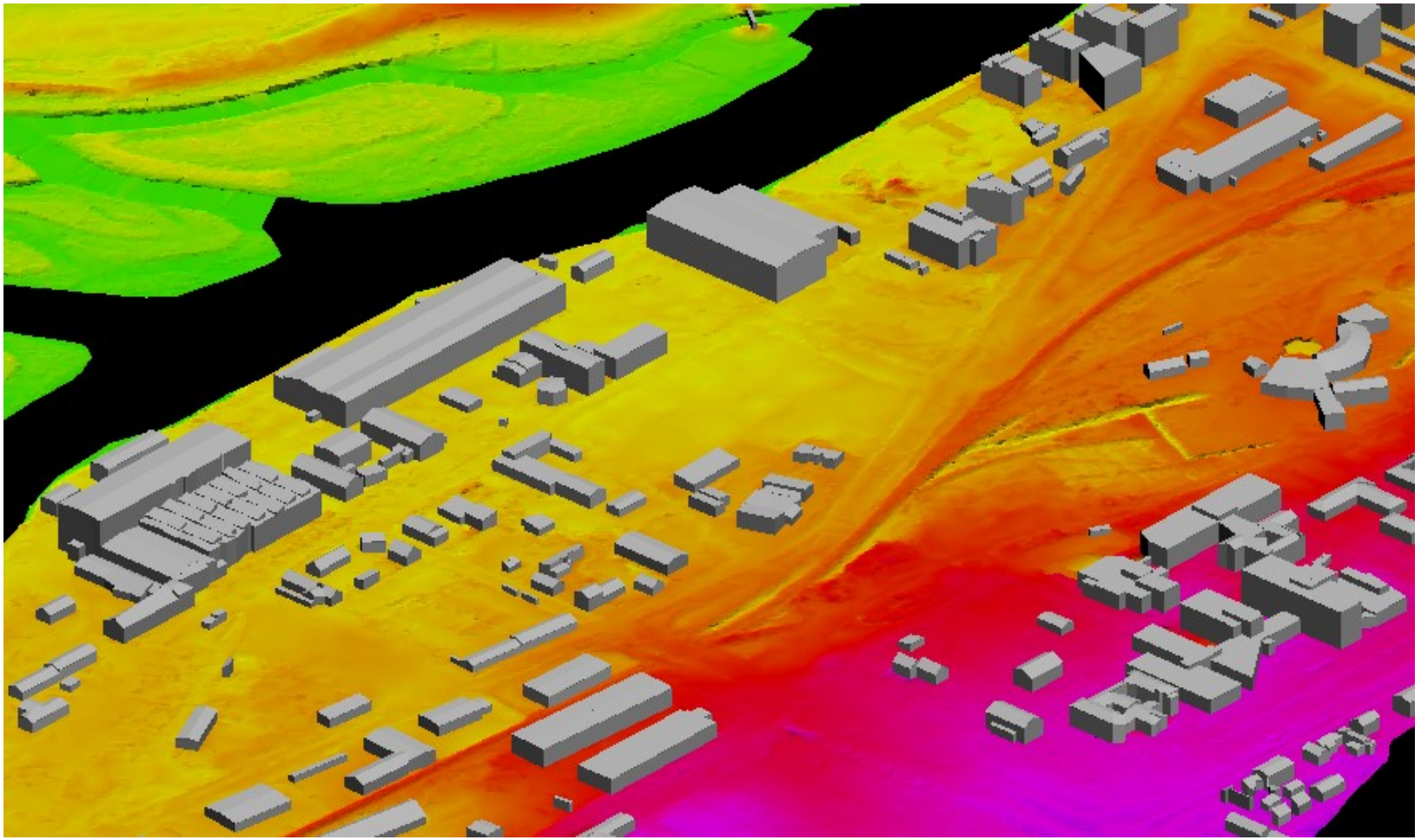
Automatic building vectorization



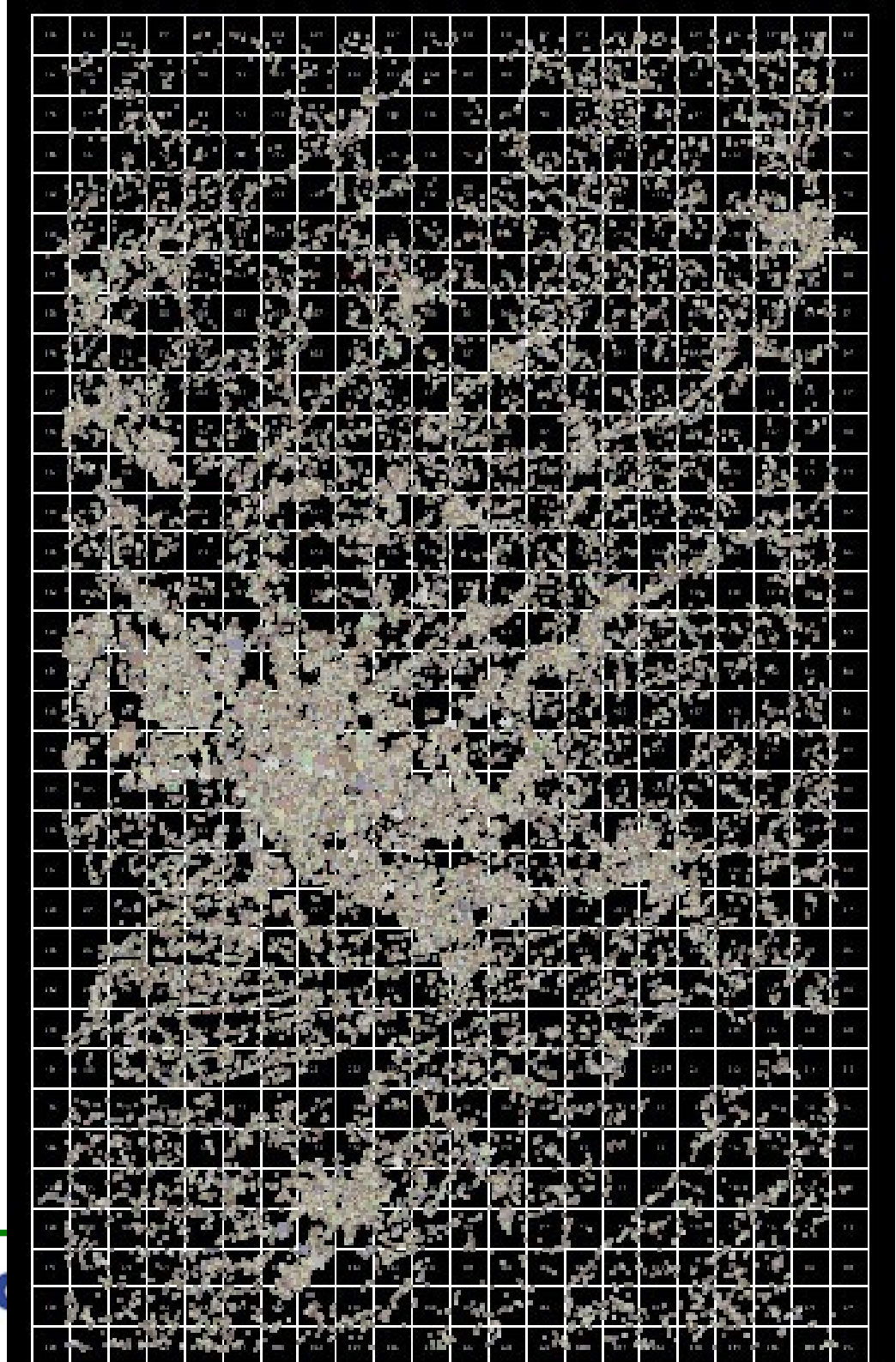
Terrasolid

TerraScan

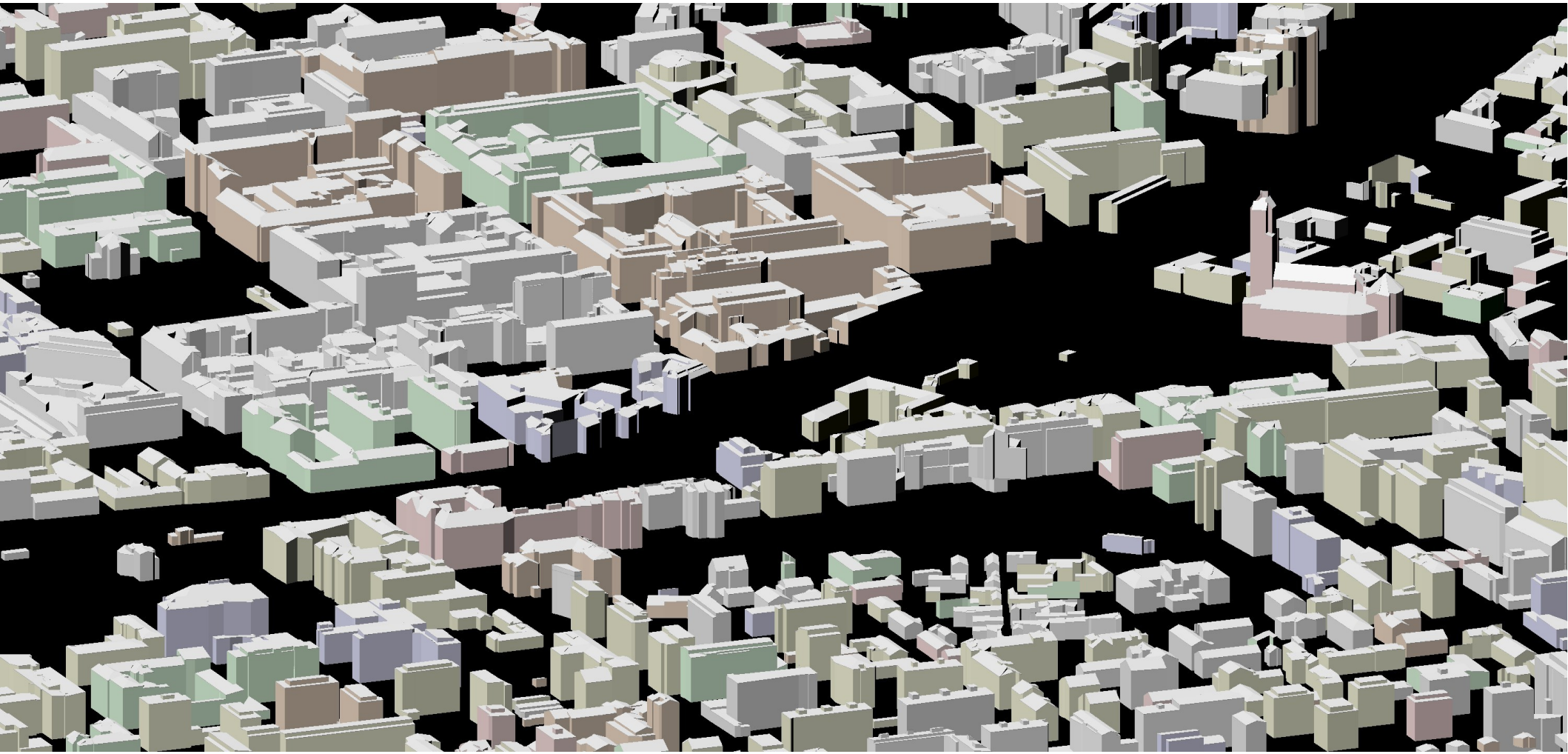
- Automatic building vectorization



- 33 km wide
- 51 km high
- 3 billion points
- Automatic building classification
- Automatic building vectorization
- 72,000+ buildings
- 6 hours vectorization



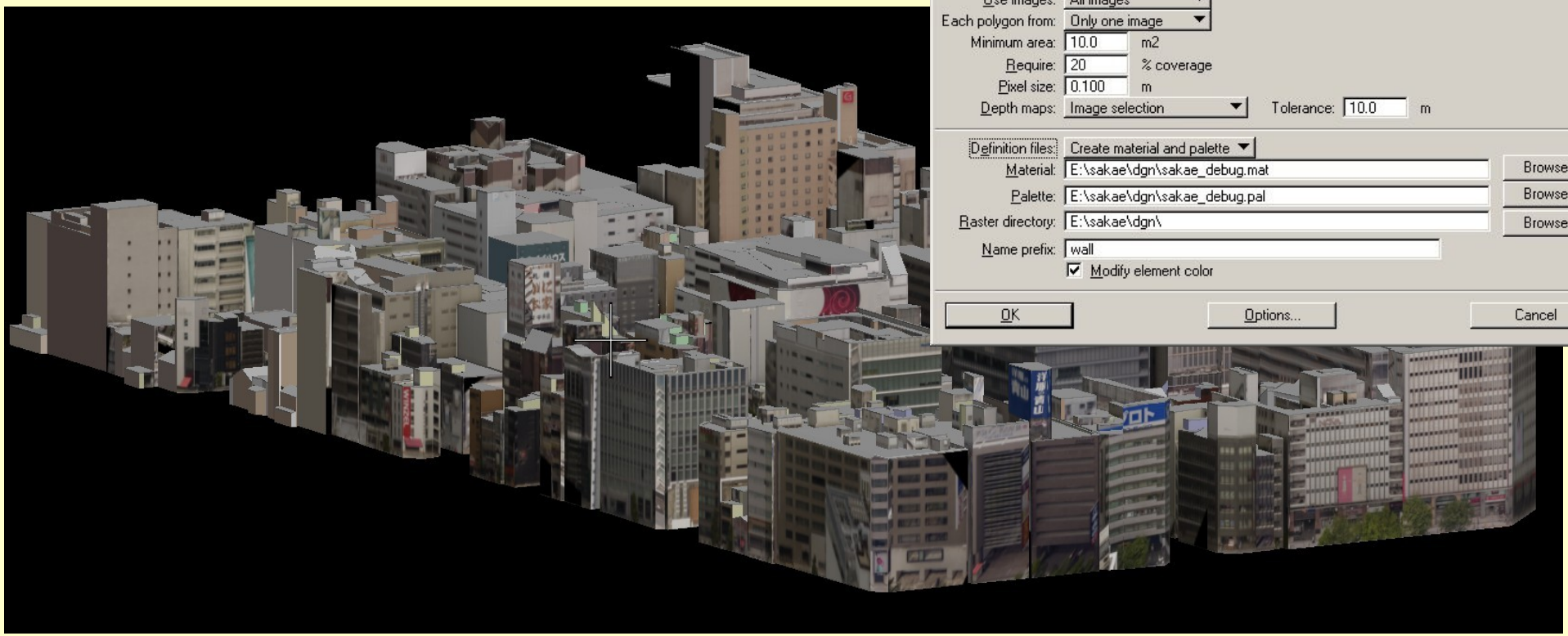
3D-building model



Terrasolid

Rectify / Wall rasters

- Creates visualization rasters for walls
- First version produces reasonable results from oblique airborne images



Terrasolid

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Helsinki Tram Survey

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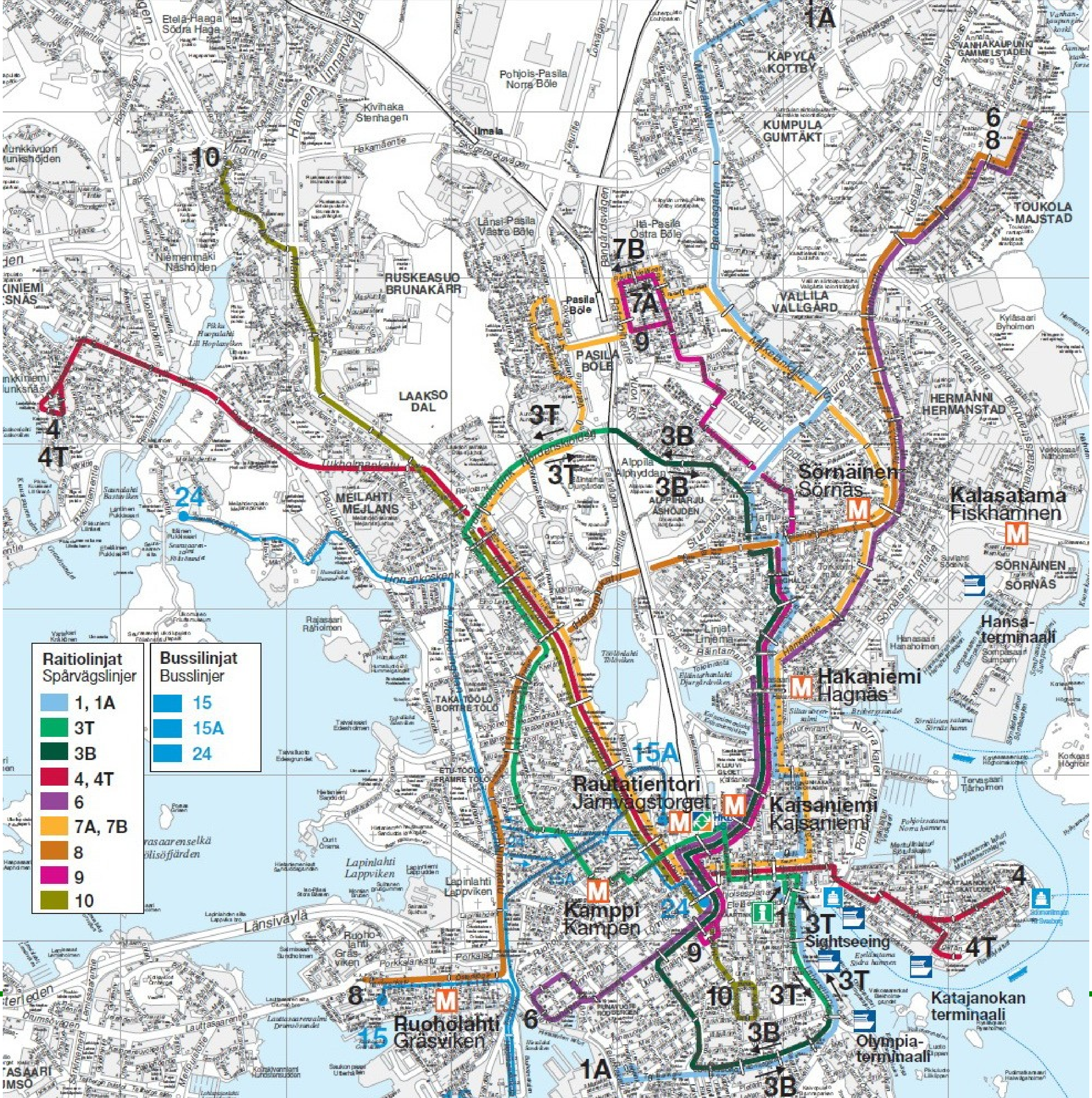
Helsinki Tram Network

- About 200 000 passengers per day
- Lines 1, 1A, 3T, 3B, 4, 4T, 6, 7A, 7B, 8, 9, 10
- 85 kilometers of commuter track
- 97 kilometers of track in total



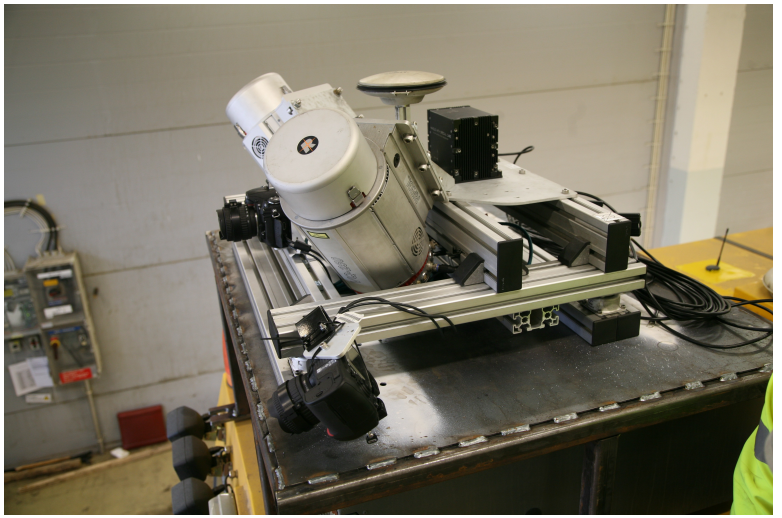
Raitiolinjat
Spårvägslinjer
1, 1A
3T
3B
4, 4T
6
7A, 7B
8
9
10
Bussilinjat
Busslinjer
15
15A
24
Rautatientori
Järnvägstorget
Kaisaniemi
Kajsaniemi
Kamppi
Kampen
Hakaniemi
Hagnäs
Sörnäinen
Sörnäs
Kalasatama
Fiskhamnen
Ruoholahti
Gräsviken
Hansa-terminaali
Katajanokan terminaali
Olympia-terminaali
Sightseeing
KÄPYLÄ
KOTTBY
KUMPULA
GUMTÄKT
VALLILA
VALLGÅRD
HERMANNI
HERMANSTAD
TOUKOLA
MAJSTAD
PASILA
BÖLE
LAAKSO
DAL
MEILAHTI
MEJLANS
RUSKEASUO
BRUNAKÄRR
TAKA-TÖÖLÖ
BORTRE TÖLÖ
ETU-TÖÖLÖ
FRÄMRE TÖLÖ

Data Volume

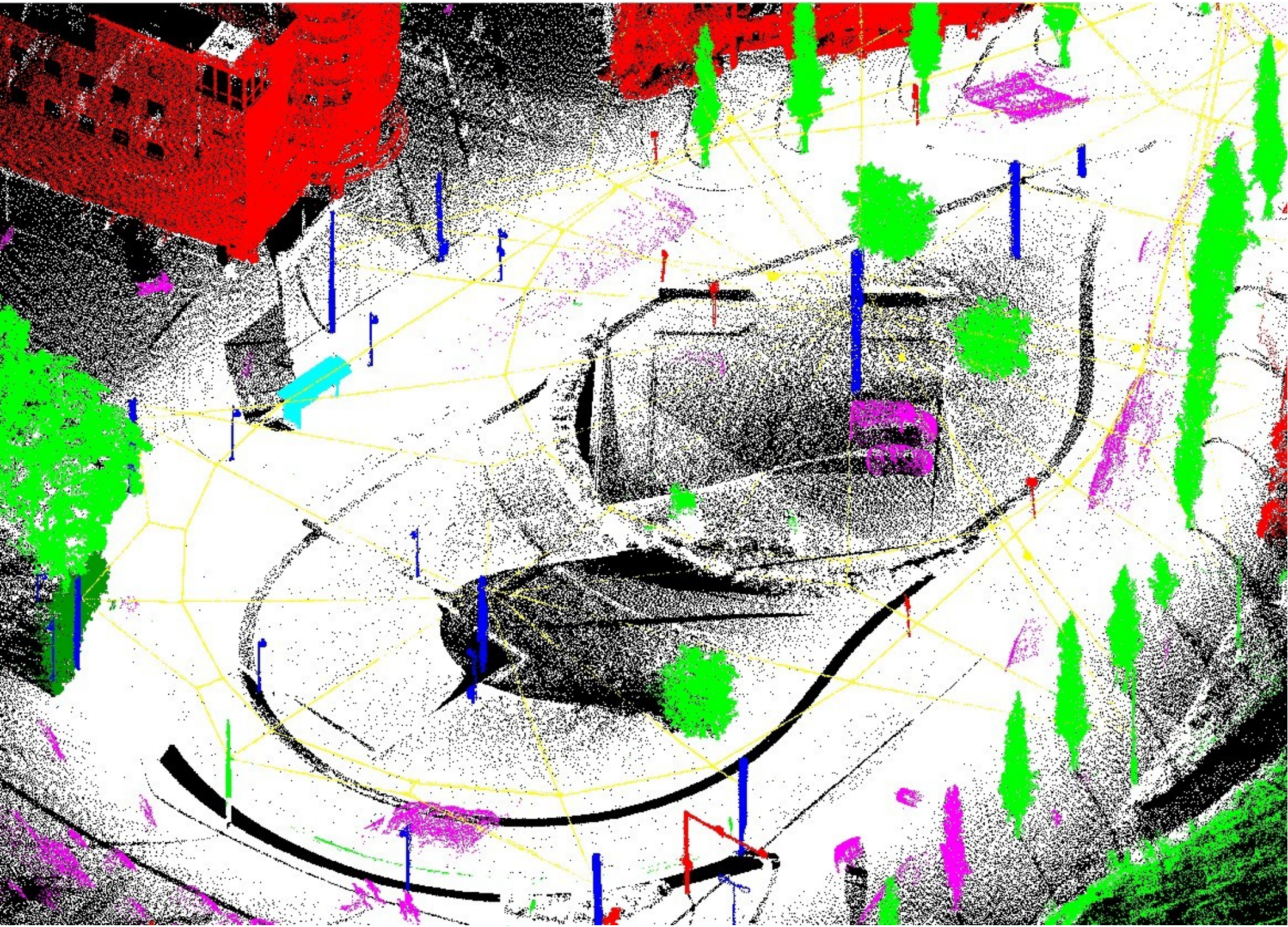
- 14 603 216 184 laser points collected
  - 462 GB as .las files

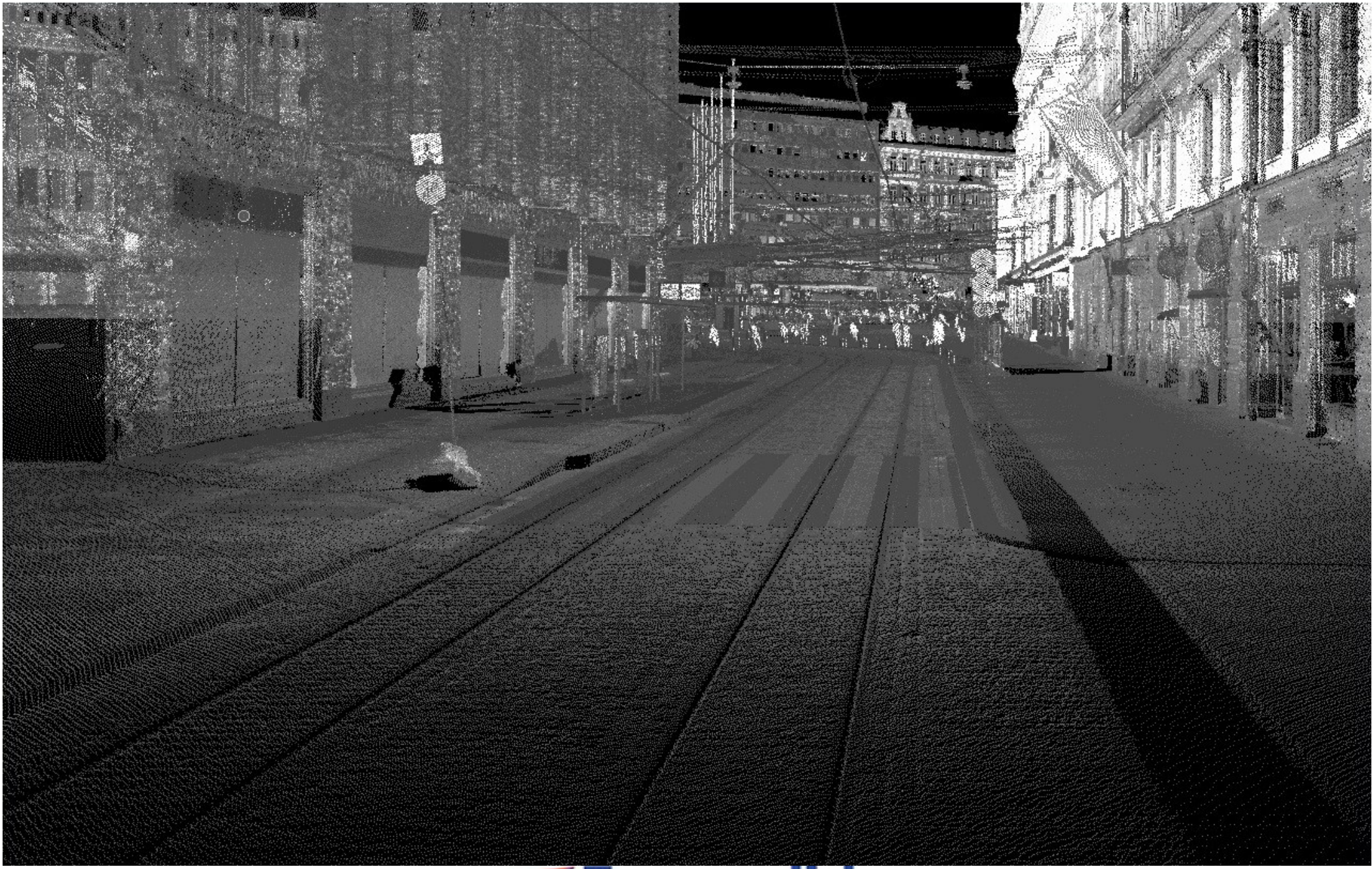
- 19628 forward looking images recorded
  - 15 GB as .jpg images

Data Collection



- Carried out by 3D Laser Mapping
- StreetMapper mounted on a tram
  - 2 * 200 000 Hz scanner
  - Forward looking 2144 * 1424 camera
- Tram installation 29th May 2011
- Data collection drives 29th - 31st May 2011
- Some images collected with system mounted on a car 1st June 2011





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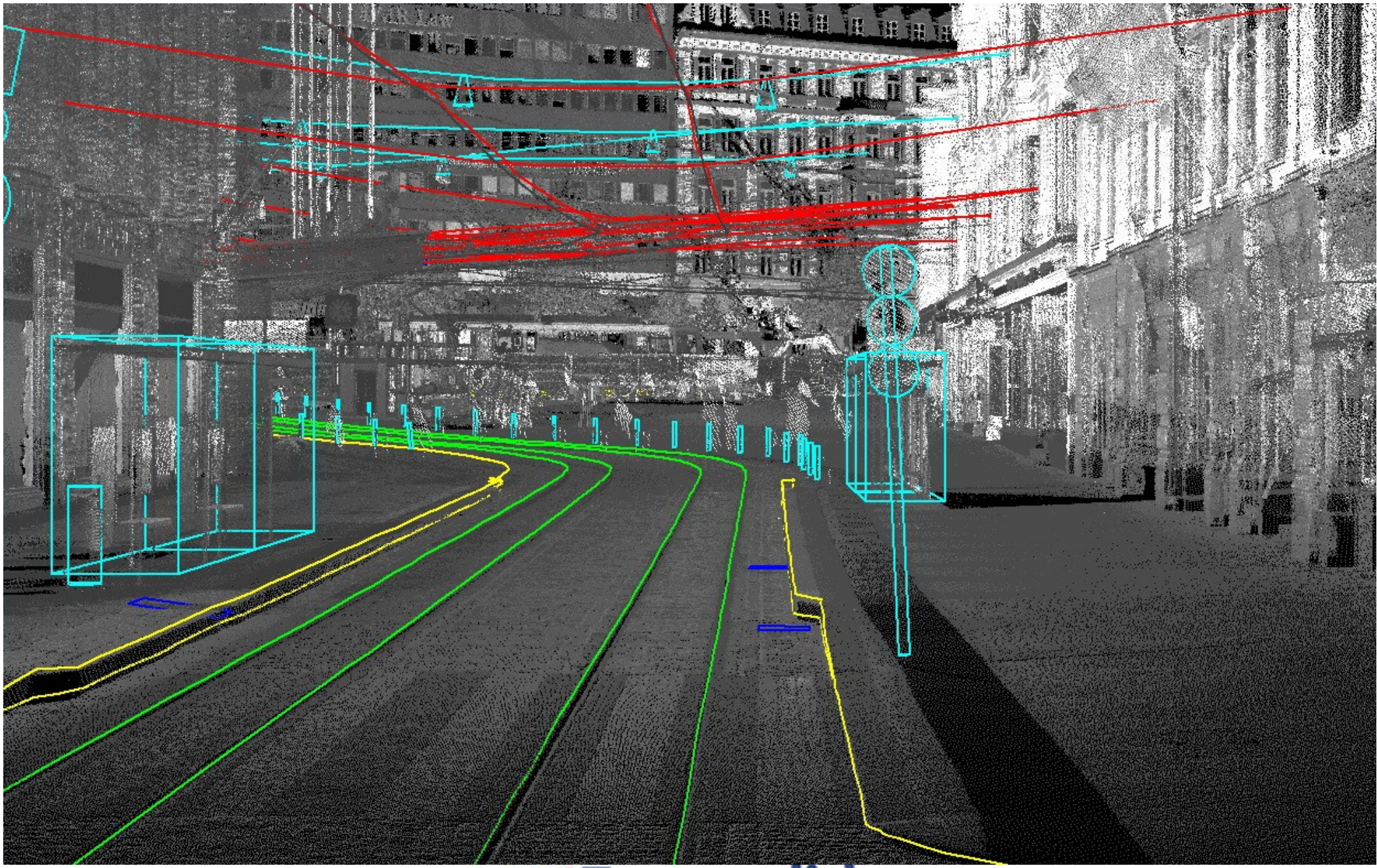
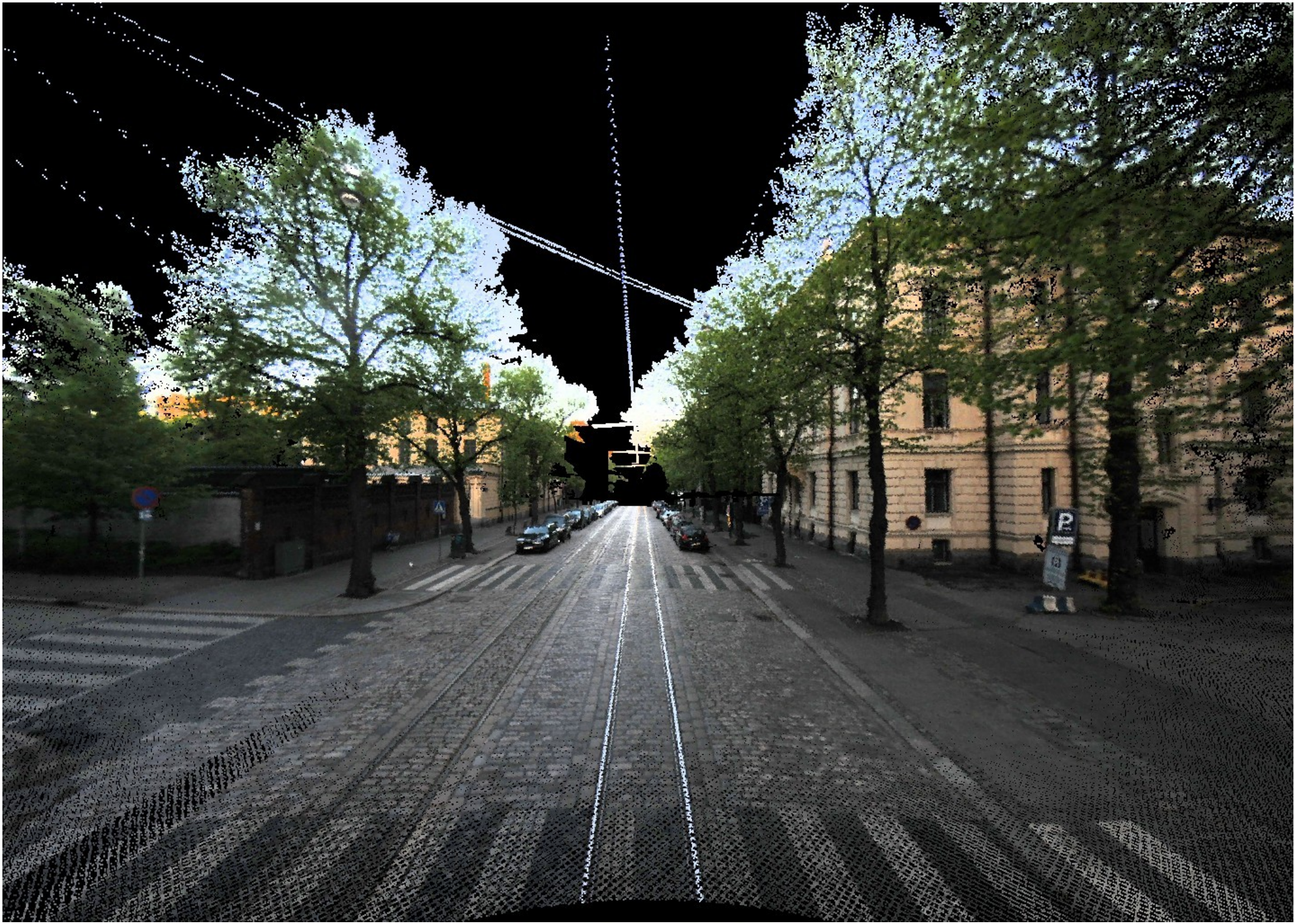


Terrasolid



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