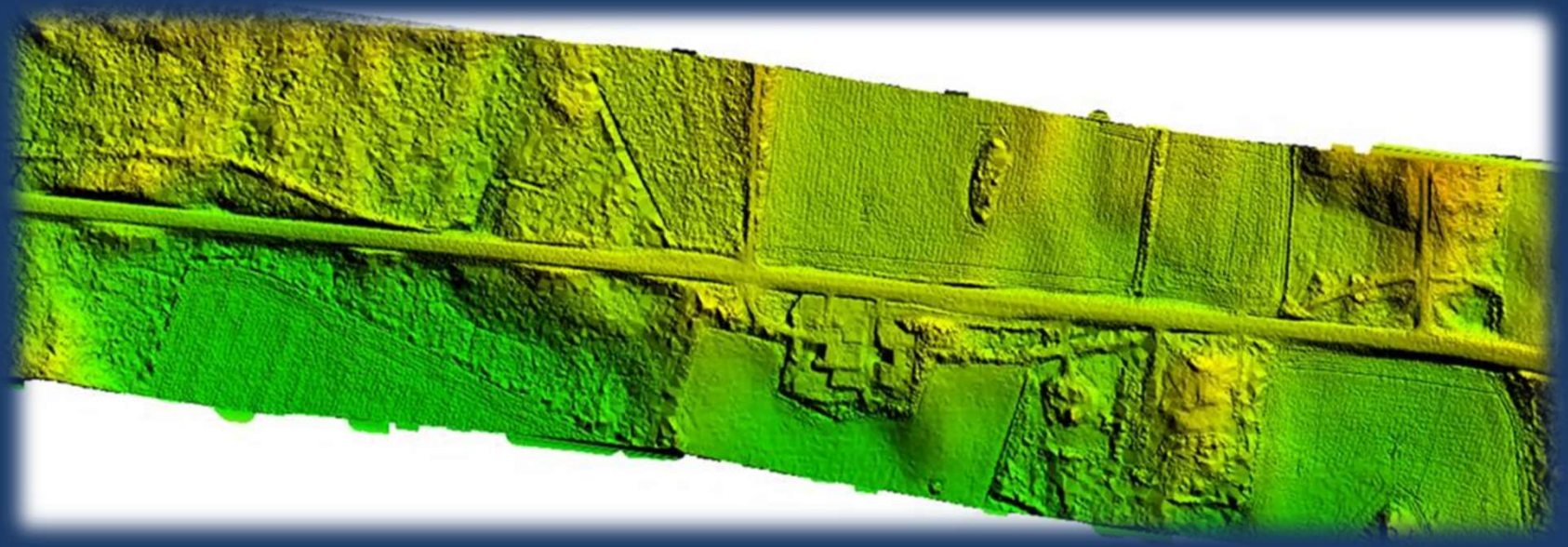
Hva er laserdata?

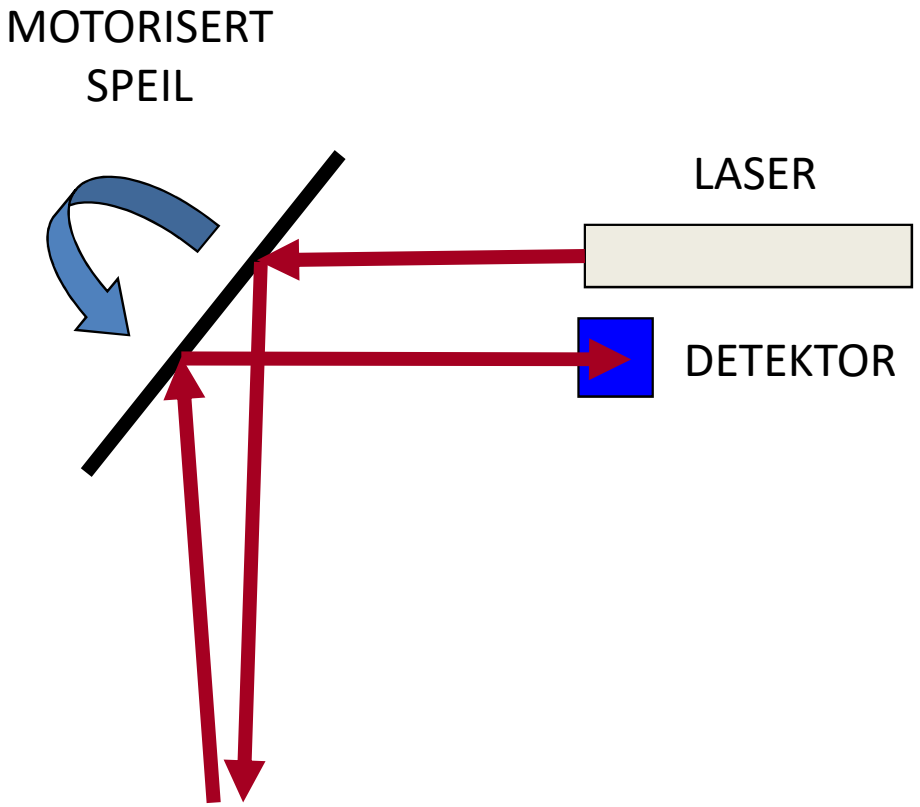
-den fulle verdien av skattene gjemt i NDH-data



Dagrun Aarsten, FoU-sjef, TerraTec AS dagrun.aarsten@terratec.no

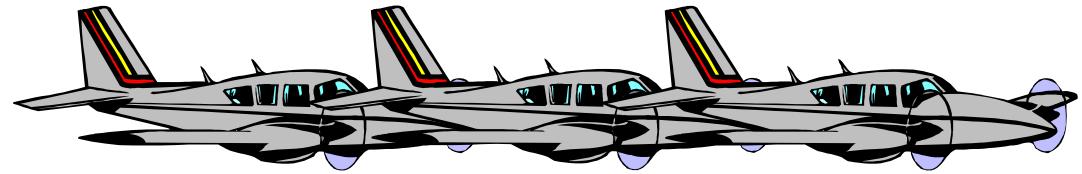
terratec

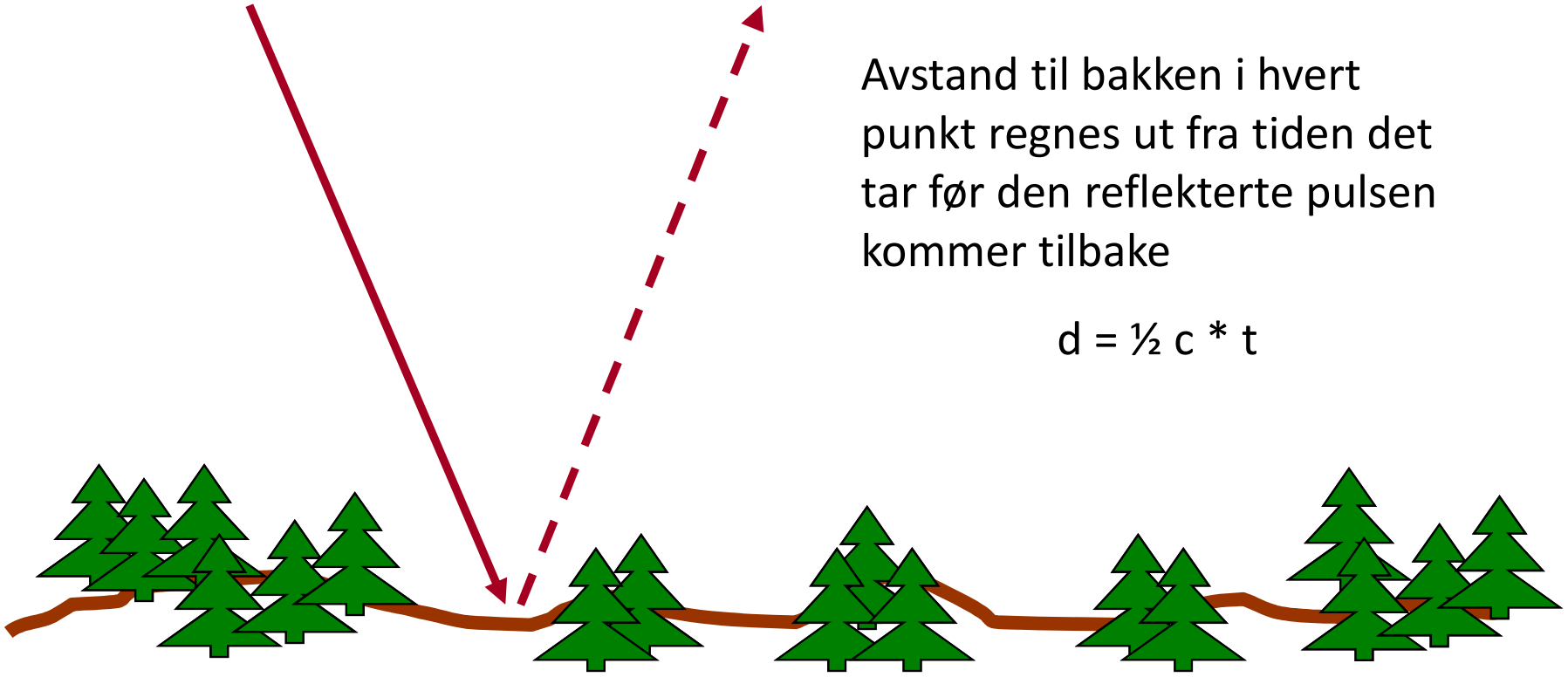
Måleprinsipp



- Laser sender ut korte, intense lyspulser, opptil 1 000 000 per sekund
- Pulsene sendes i forskjellig retning ved hjelp av et motorisert speil eller annen skannemetode
- De reflekterte pulsene fra bakken fanges opp av en detektor

Måleprinsipp

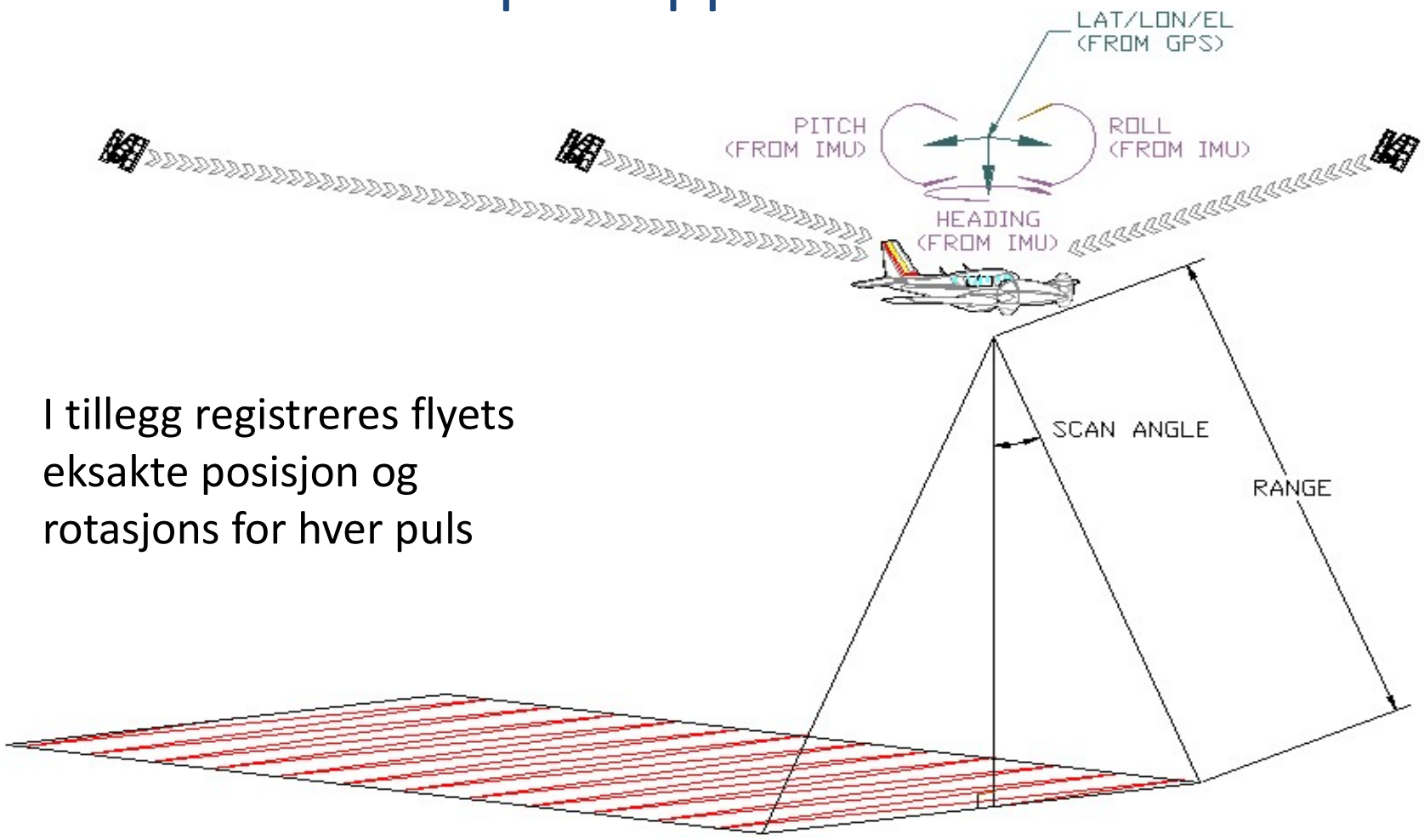




Avstand til bakken i hvert punkt regnes ut fra tiden det tar før den reflekterte pulsen kommer tilbake

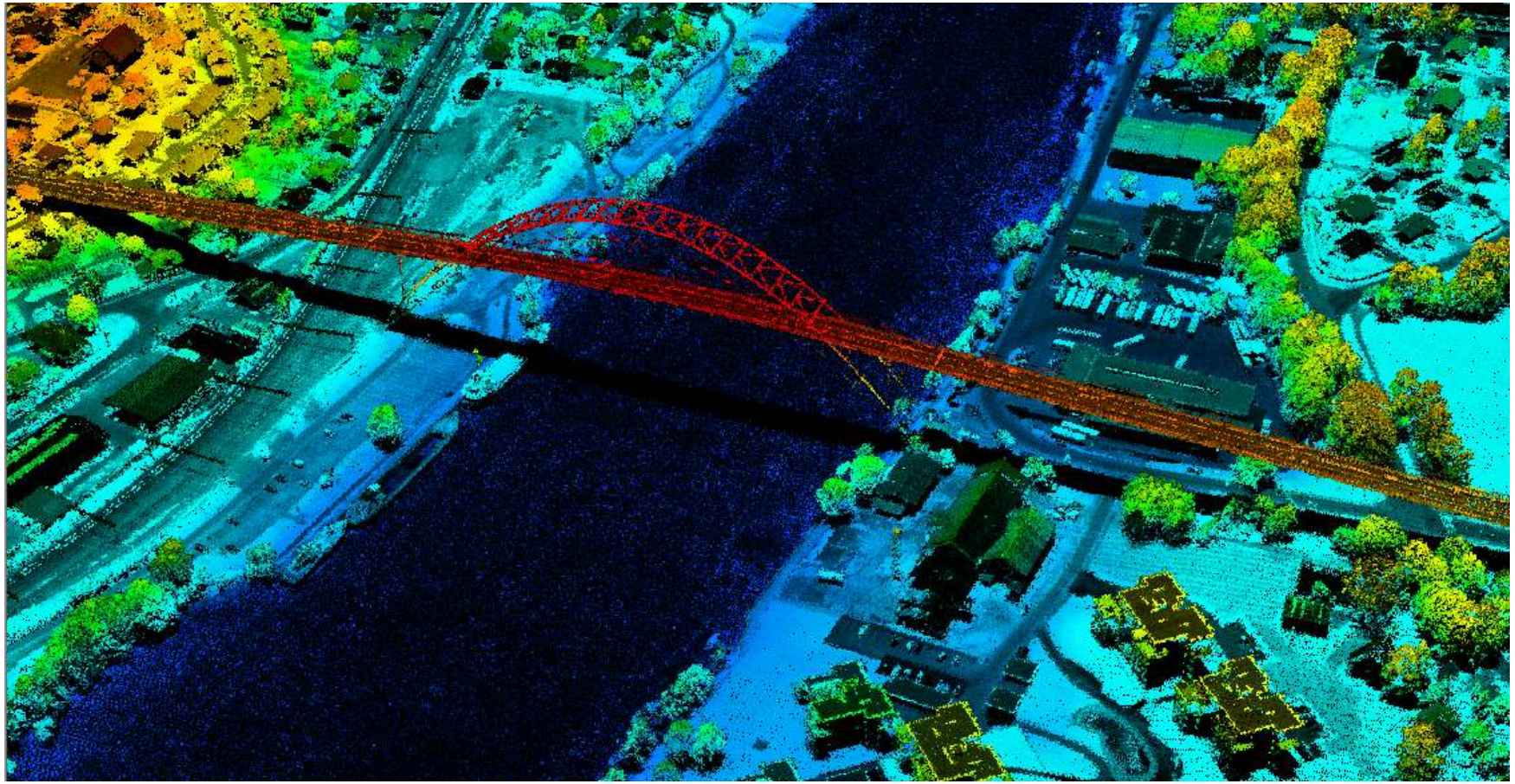
$$d = \tfrac{1}{2} c * t$$

Måleprinsipp



I tillegg registreres flyets eksakte posisjon og rotasjons for hver puls

Resultat: En svært nøyaktig punktsky i 3D



Historikk LiDAR (Light Detection and Ranging)

- 1989: Laser profiler fra Optech benyttet i fly som en del av doktorgradsarbeidet til Peter Friess og Joachim Lindenberger. Løsningen gav gode terrengprofiler hvor terreng, vegetasjon, kraftlinjer etc. var godt synlige.
- Ideen om en skannende laser ble introdusert i dette arbeidet. Første skannende laser fra Optech ble levert til TopScan (Peter og Joachim sitt selskap) i **1993**; Optech ALTM (Airborne Laser Terrain Mapper). Øivind Aase var til stede i 93 da de fløy de første testene Denne laseren hadde en pulsrate på **2000 Hz**.
- Første test av laser i Norge ble gjennomført høste 1995. Dette var et samarbeidsprosjekt mellom Fotonor og flere norske offentlige etater. Norges Skogeierforbund ble også invitert til å delta i testen. Skogeierforbundet sendte denne «ballen» til Erik Næsset ved NLH, og slik kom Erik noe motvillig med i denne prosessen.
- Første kommersielle prosjekt ble fløyet i 1996 av Fotonor med TopScan sin sensor i forbindelse med ny gassrørledning Europipe 2 til Kårstø . Har var det behov for terrengdata raskt, og med tradisjonelle kartleggingsmetoder ville det ikke være mulig å få fram data raskt nok.
- Neste generasjon Optech ALTM med **5000 Hz** pulsrate kom i **1996/97**.

Historikk LiDAR (Light Detection and Ranging)

- I 1998 kom det ny laserteknologi som muliggjorde **10 000 Hz** pulsrate. Fotonor bestilte et instrument av typen Optech ALTM 1210 i 1998. Dette ble levert i januar 1999 og var det første systemet i verden med **10 KHz**. Fotonor deltok i første runde med heldekkende høydemodell for Nederland. Så å si alle prosjekt de første årene var utenfor Norge.
- Det dukket etter hvert opp flere leverandører av laserscannere (TopoSys, Eagle Eye, Riegl +) Leica kom med sin ALS40 (kom i 2002/2003) etter å ha kjøpt Eagle Eye i USA. Etter dette kom ALS 50 med **50 000 Hz**.
- Svært få laserprosjekter i Norge. Statens Vegvesen hadde noen pilotprosjekter og i 2005 gjennomførte Kartverket noen testprosjekter. Først i 2006 ble laser godkjent som en fullverdig løsning for innsamling av høydedata av Statens Kartverk. (Kunne erstatte konstruksjon av høydekurver)
- Første ALS 50-II med en helt ny laserløsning kom i 2005/06. TerraTec kjøpte det første instrumentet som ble levert fra Leica i USA. Dette systemet hadde en ny laserteknologi med betydelig høyere ytelse. Pulsraten var **150 000 Hz**

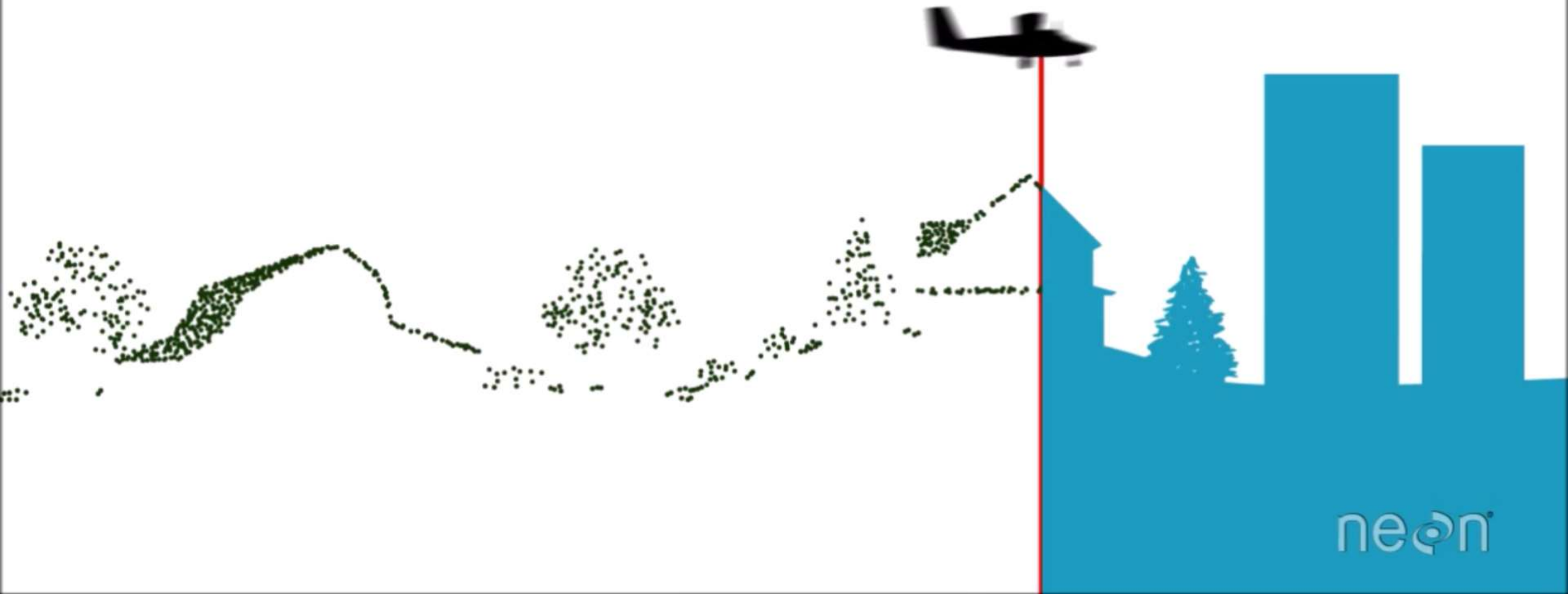
«Nyere» laserhistorie i TerraTec AS

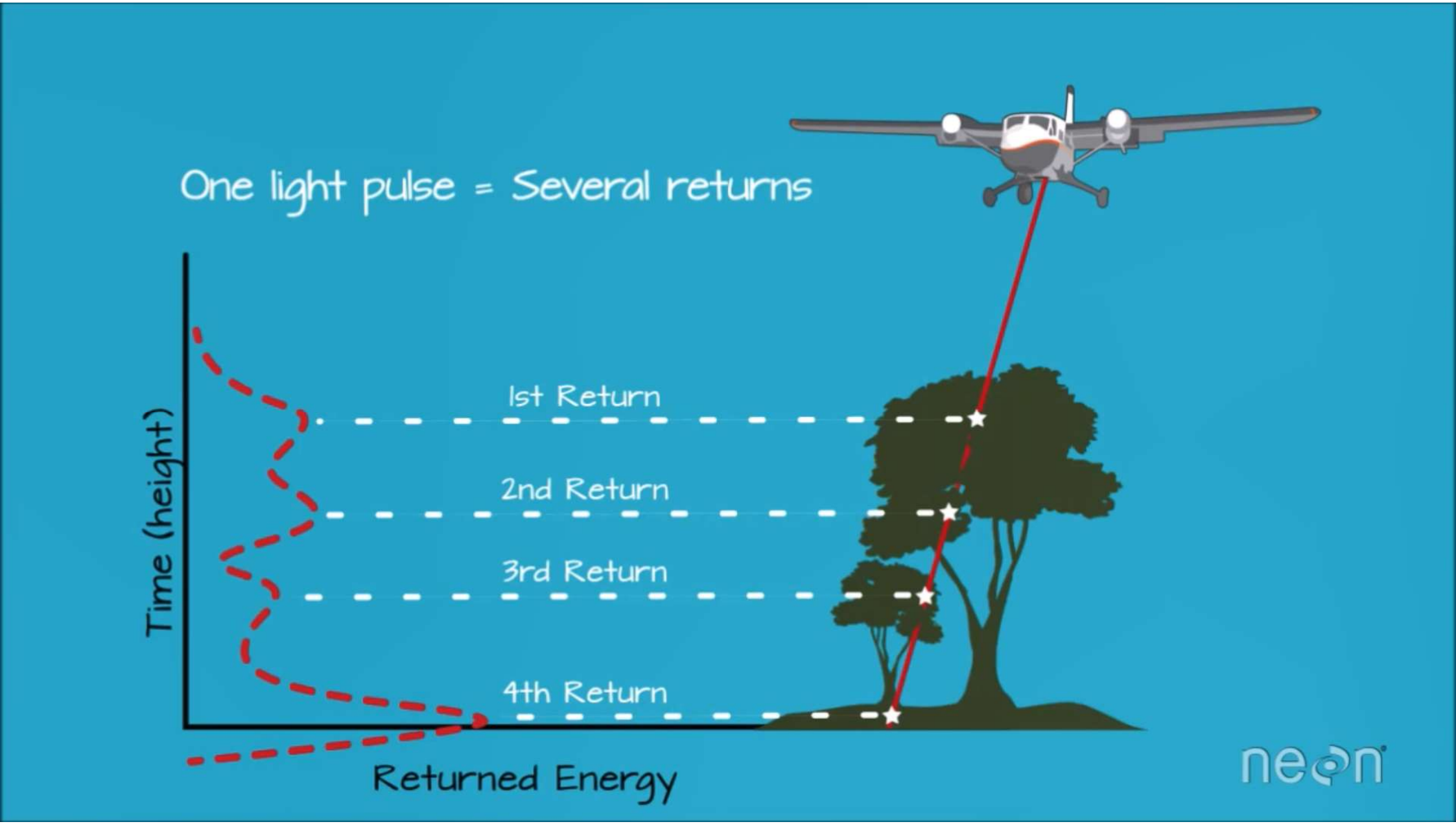
År	Sensor	Nyheter	SNR 1?
2006	**Leica ALS-50-II**	Kort, presis puls, lite fotavtrykk, høy effekt (6000 m), 4 returer, trinnløs justering av pulsrate opp til **150 kHz**, valgfri FOV opp til 70 gr, roll-kompensasjon	Ja
2008	**Leica ALS-50-II MPIA**	Multiple pulser i lufta (MPIA) Full waveform digitizer (opsjon) Fortsatt **150 kHz** (ALS-60 hos Blom hadde **200 kHz**)	-
2011	**Leica ALS-70 HP**	Dual scan pattern, **2 x 250 kHz = 500 kHz** Mer optimal punktdistribusjon, tok i bruk gyrostab. plattform	Ja
2015	**Optech Titan**	Tre bølgelengder – Multispektral **3 x 300 kHz = 900 kHz**	Ja
2017	**Riegl VQ1560i**	To skannere, **1000 kHz x 2= 2000 kHz** (effektiv **1300 kHz**) MPIA: Trinnløs opp til 20 PIA, **ingen range gate** Roterende speil – svært homogen punktdistribusjon	Ja

2016: TerraTec AS tildeles kontrakt for Nasjonal Detaljert Høydemodell (NDH) – lønn for strevet for nesten 25 års pionervirksomhet for Øivind Aase

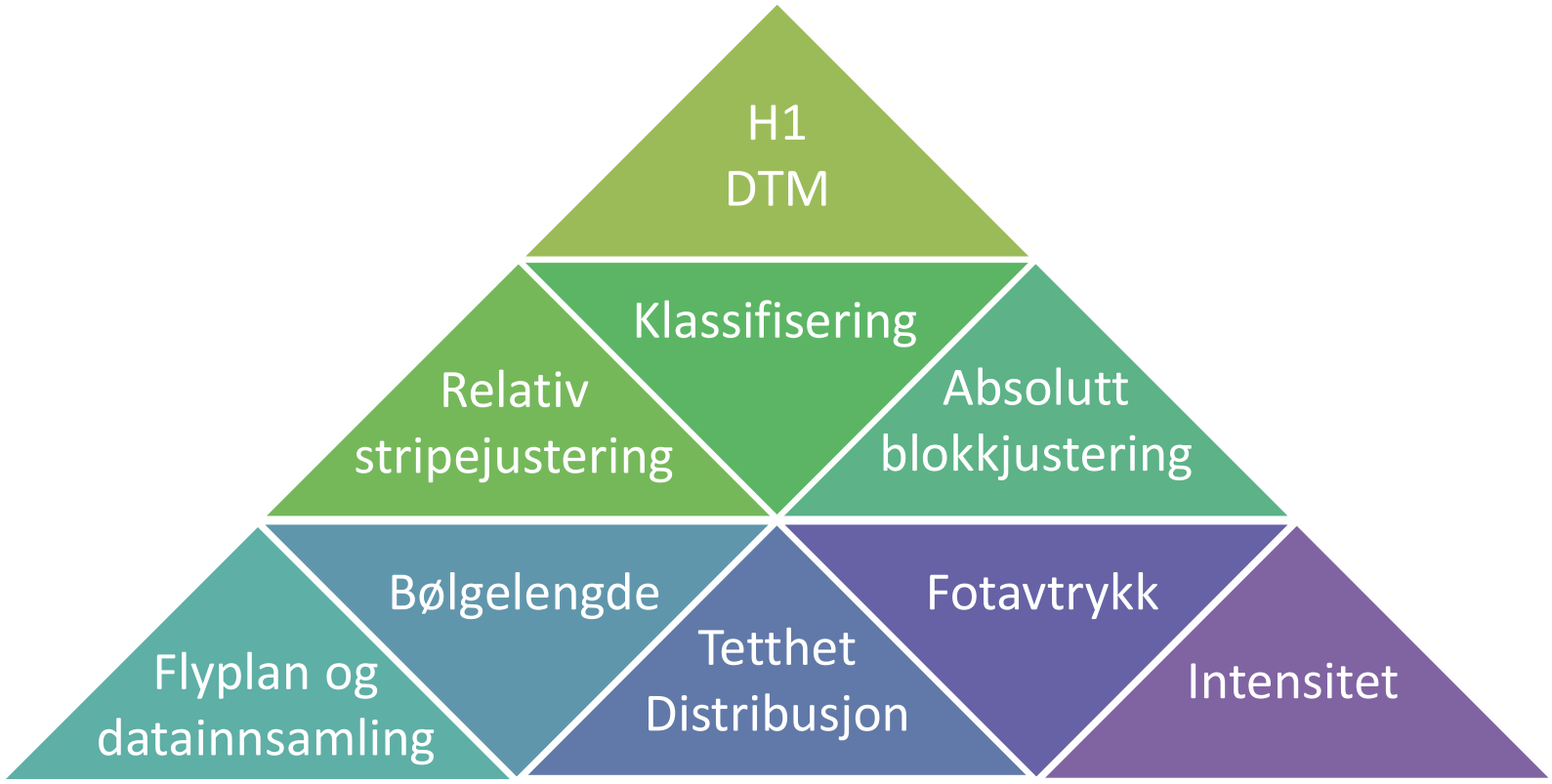
Light Detection And Ranging

Light Detection And Ranging



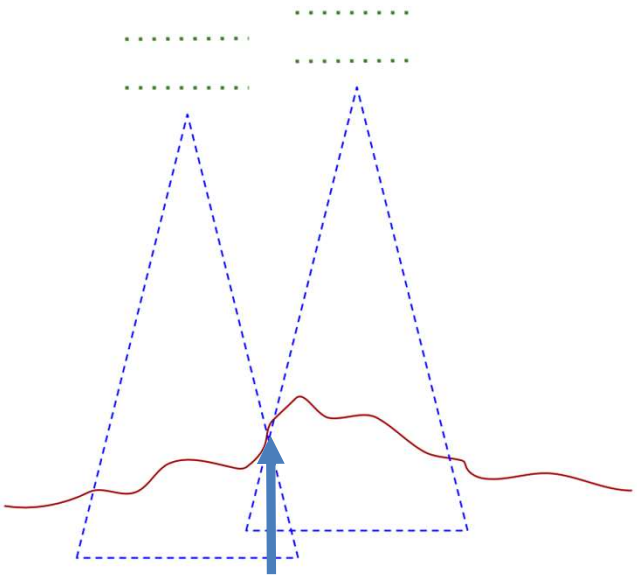

One light pulse = Several returns
1st Return
2nd Return
3rd Return
4th Return
Time (height)
Returned Energy
neon

Parametere som har innvirkning på homogenitet av DTM og høydekurver:



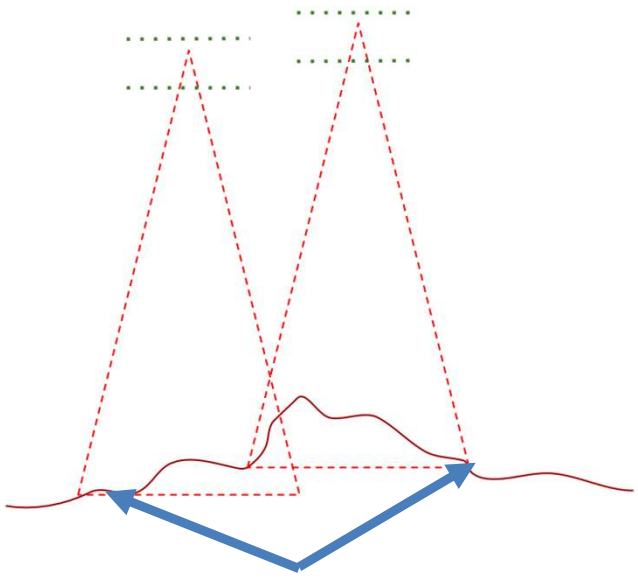
Flyplanlegging og datainnsamling

Flydd for lavt



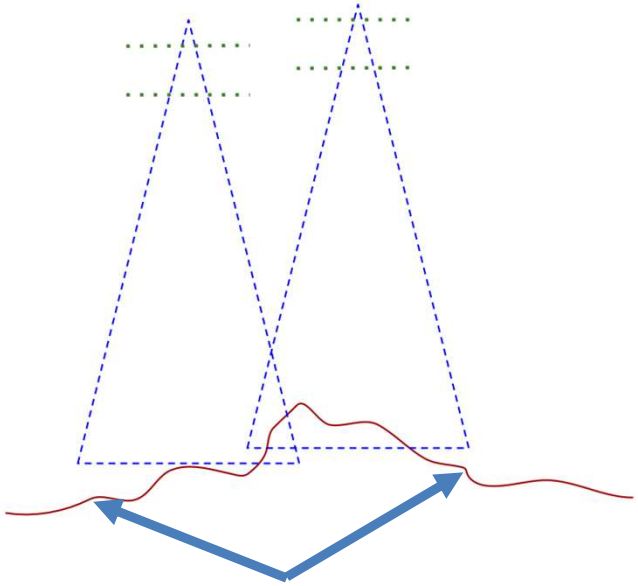
Manglende dekning

Korrekt



110% punkttetthet nivå

Flydd for høyt

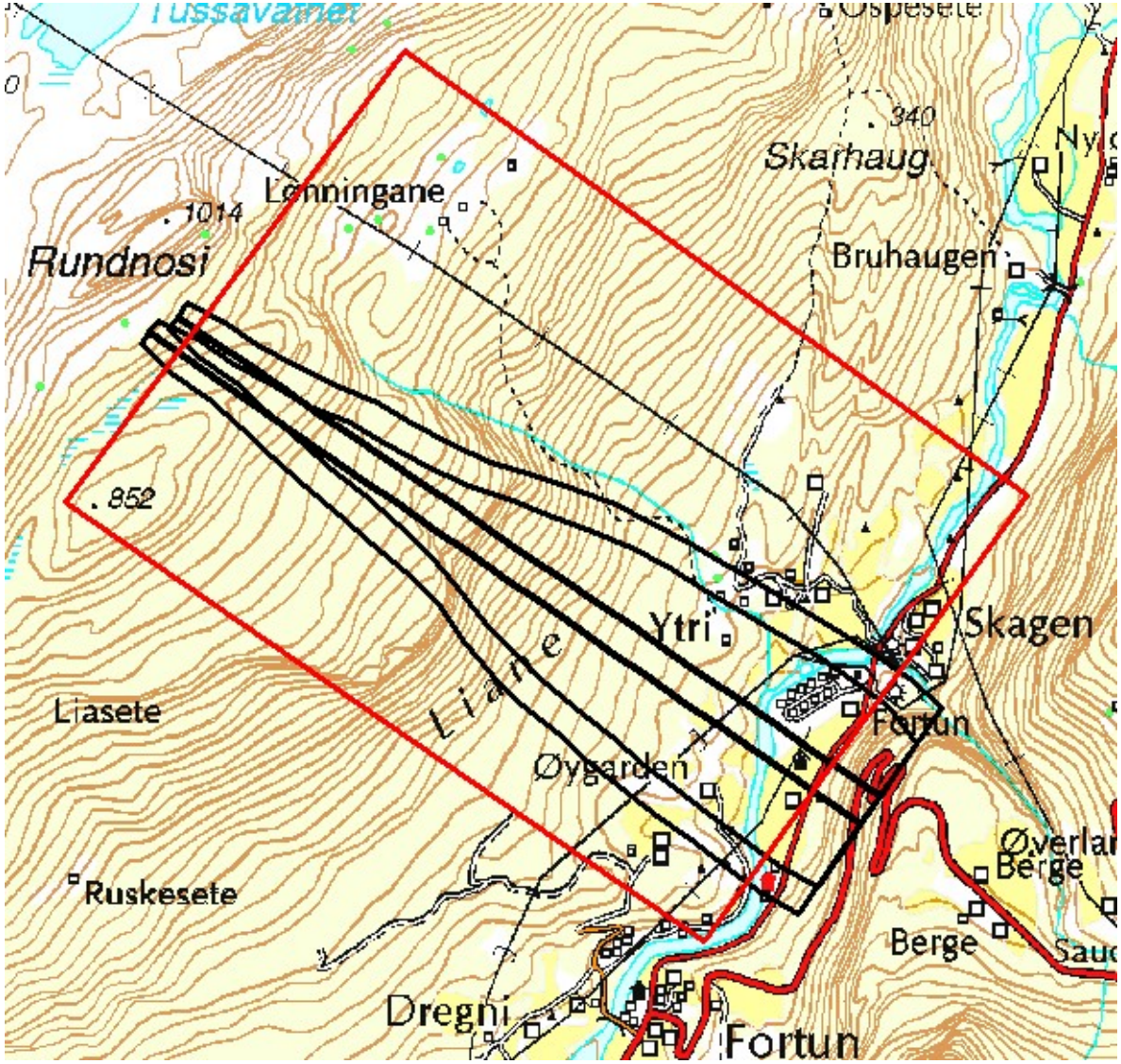


For lav punkttetthet

Flyplanlegging

Kundens krav:
- Dekning
- Punktetthet
- Skannevinkel
- Overlapp

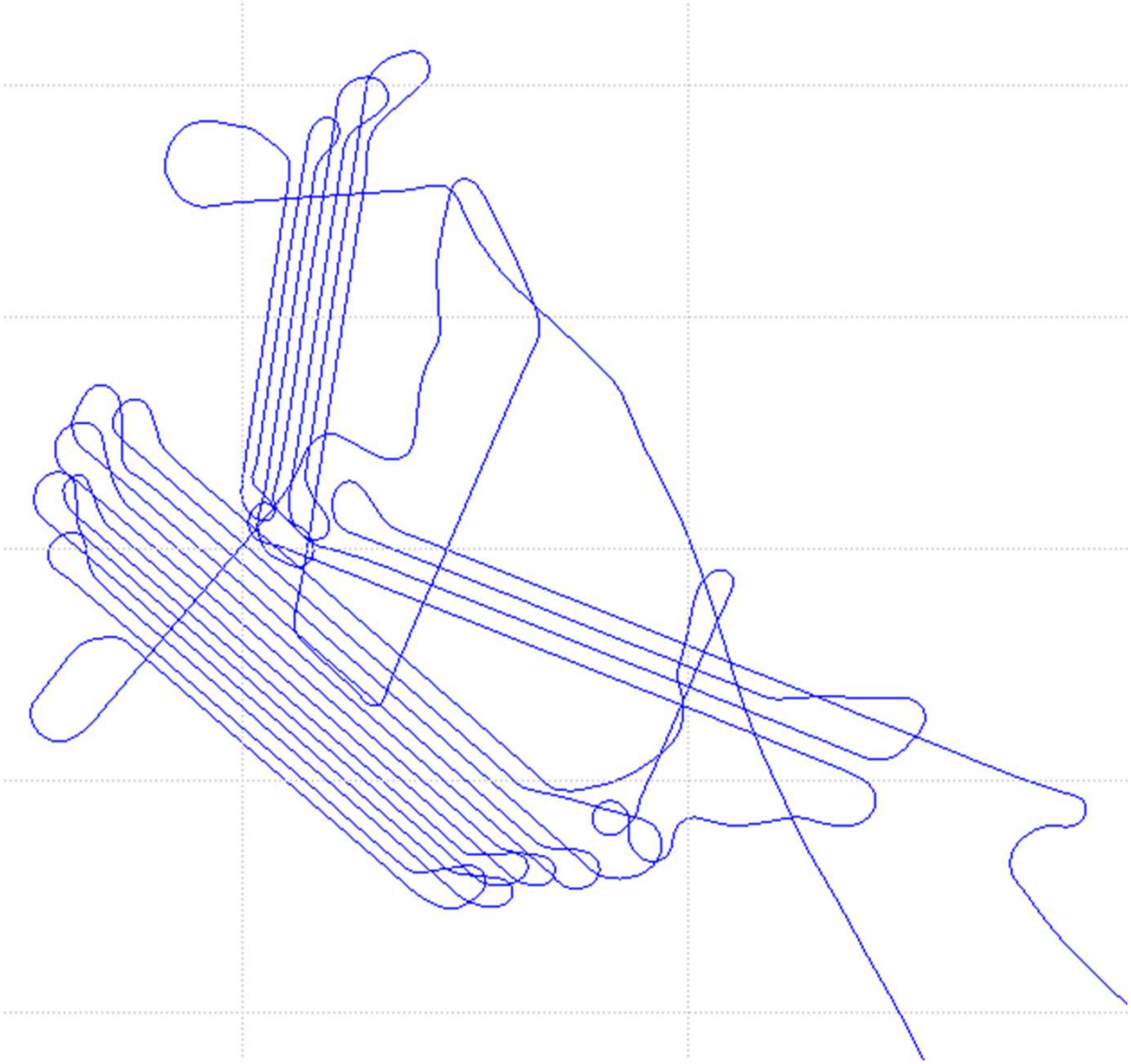
Våre "krav":
- Sikkerhet
- Effektivt
- Innsyn
- Egnet for utjevning
- Unngå drift i IMU

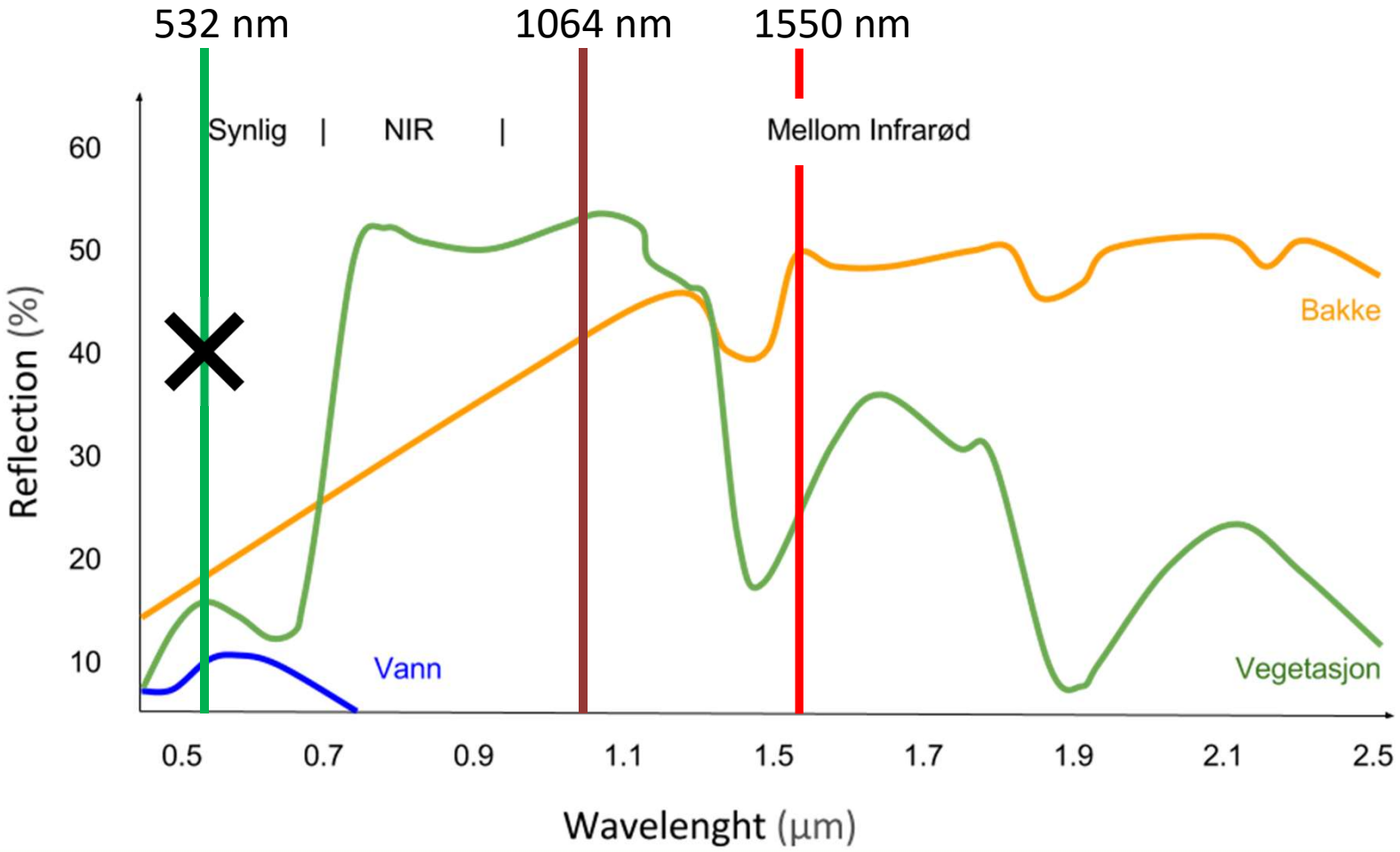


Datafangst

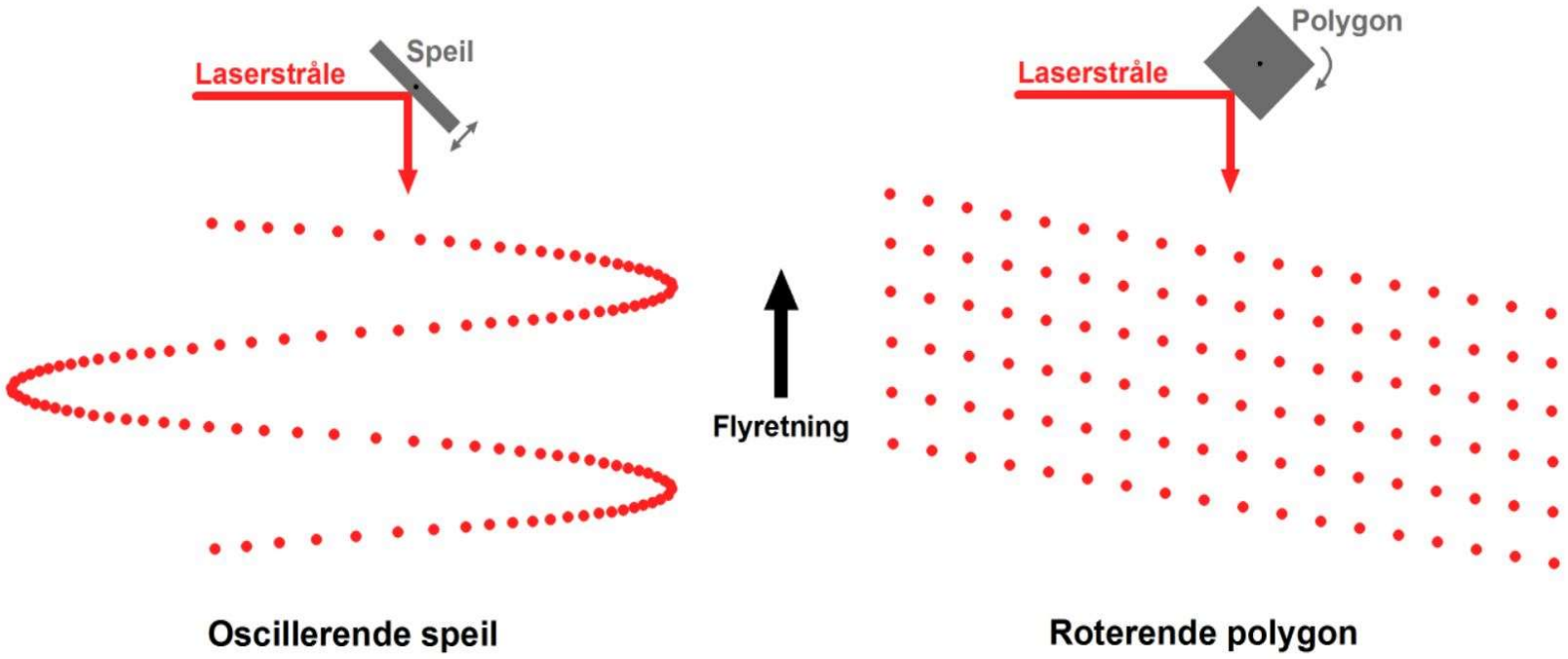
Høypresisjons

posisjons- og rotasjonsdata muliggjør absolutt georefefering av laserdata

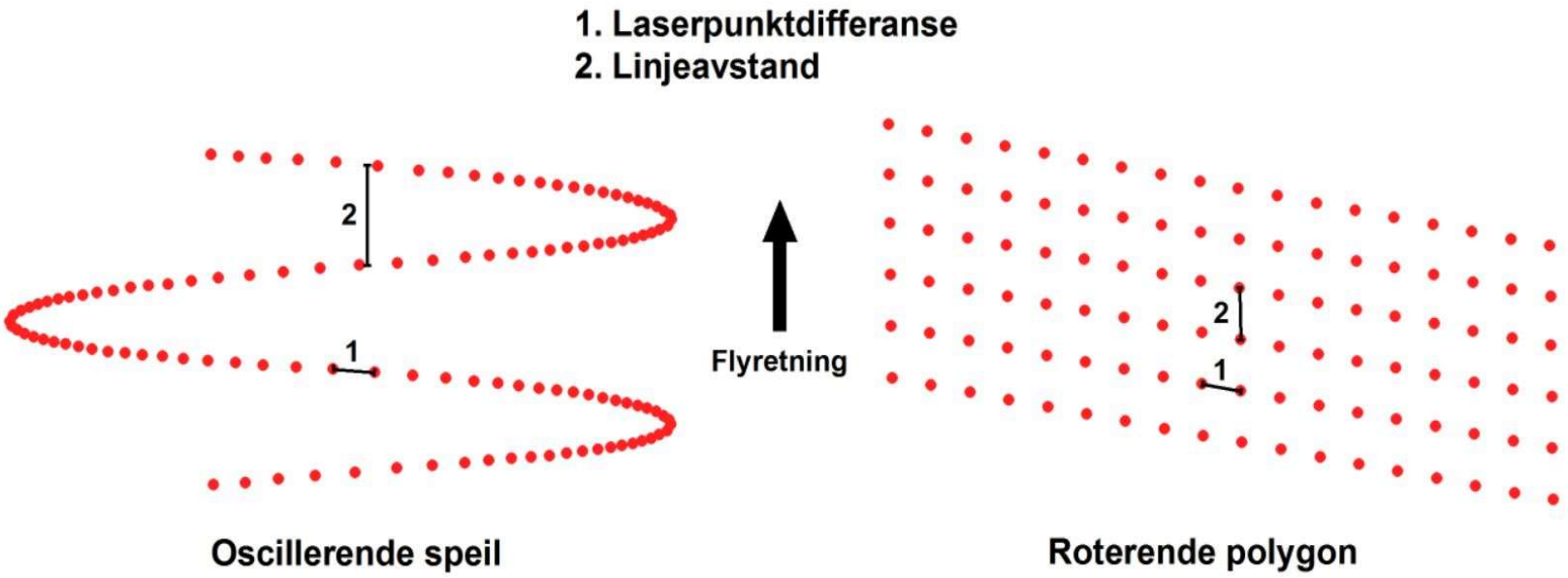



532 nm
1064 nm
1550 nm
Synlig
NIR
Mellom Infrarød
Reflection (%)
60
50
40
30
20
10
Bakke
Vann
Vegetasjon
0.5
0.7
0.9
1.1
1.5
1.7
1.9
2.1
2.5
Wavelenght (µm)

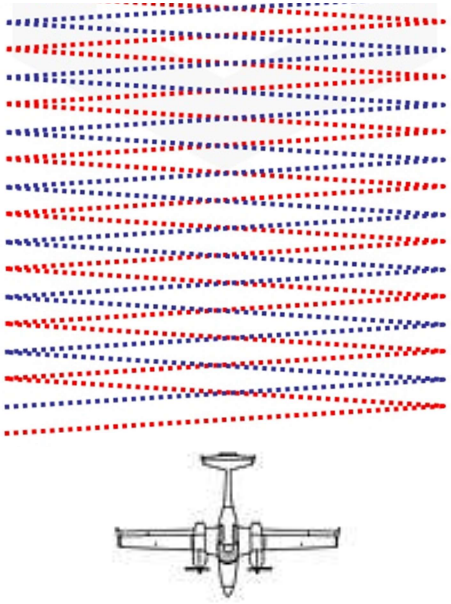
Skannemekanisme i lasersensorer



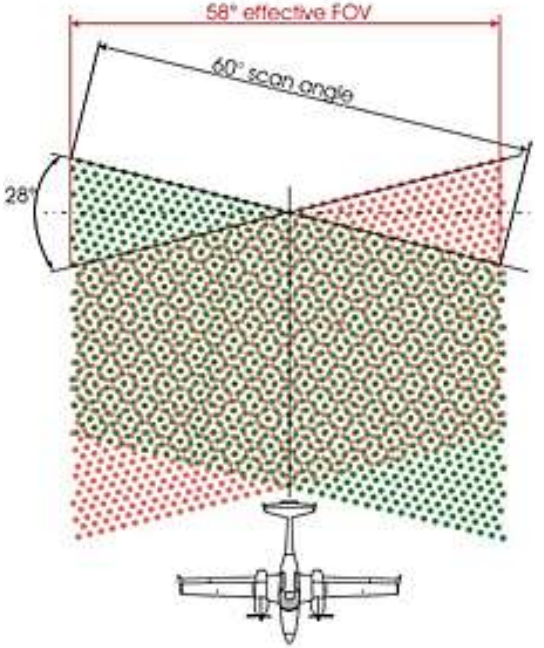
Punktsky, tetthet og distribusjon



Punktsky, tetthet og distribusjon

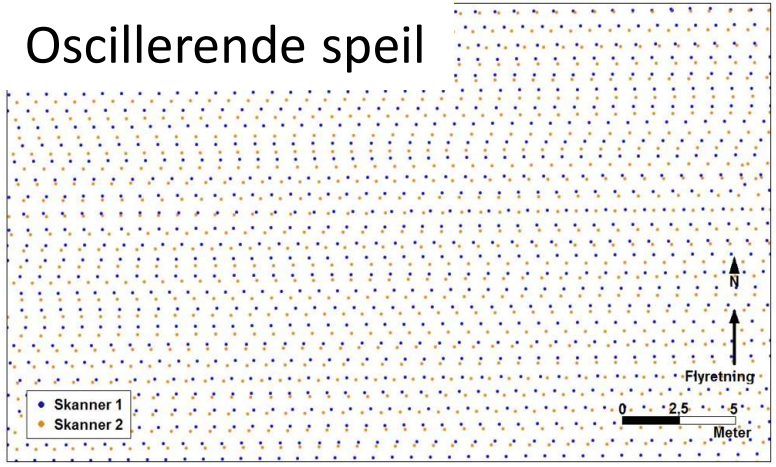


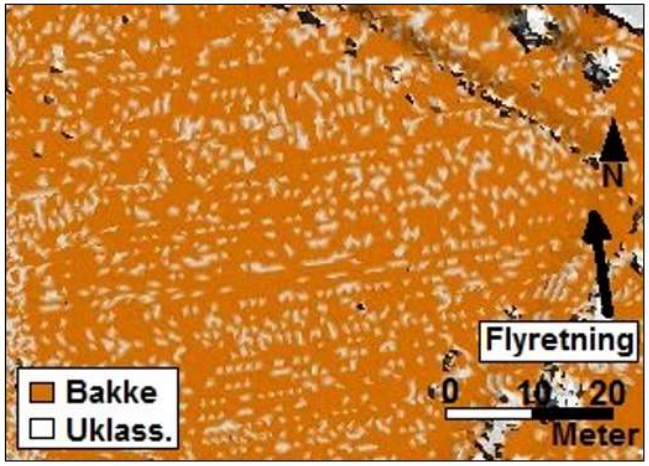
Oscillerende speil



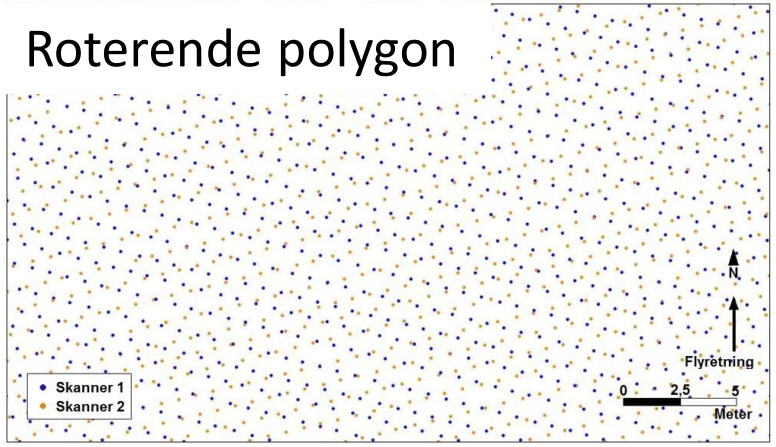
Roterende polygon

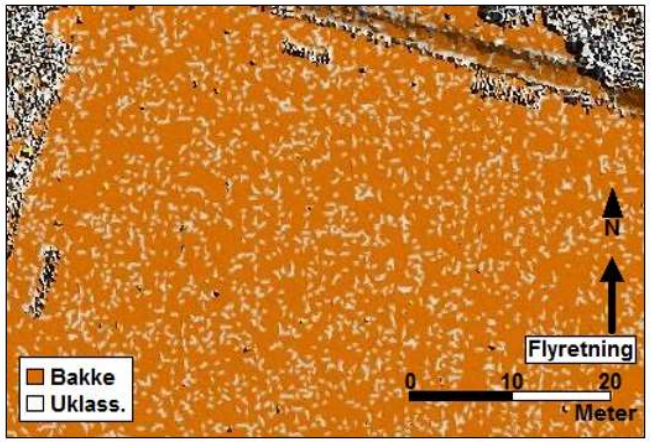
Oscillerende speil

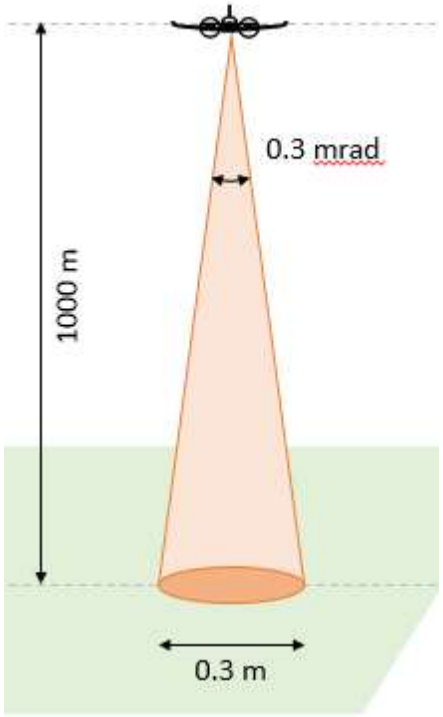


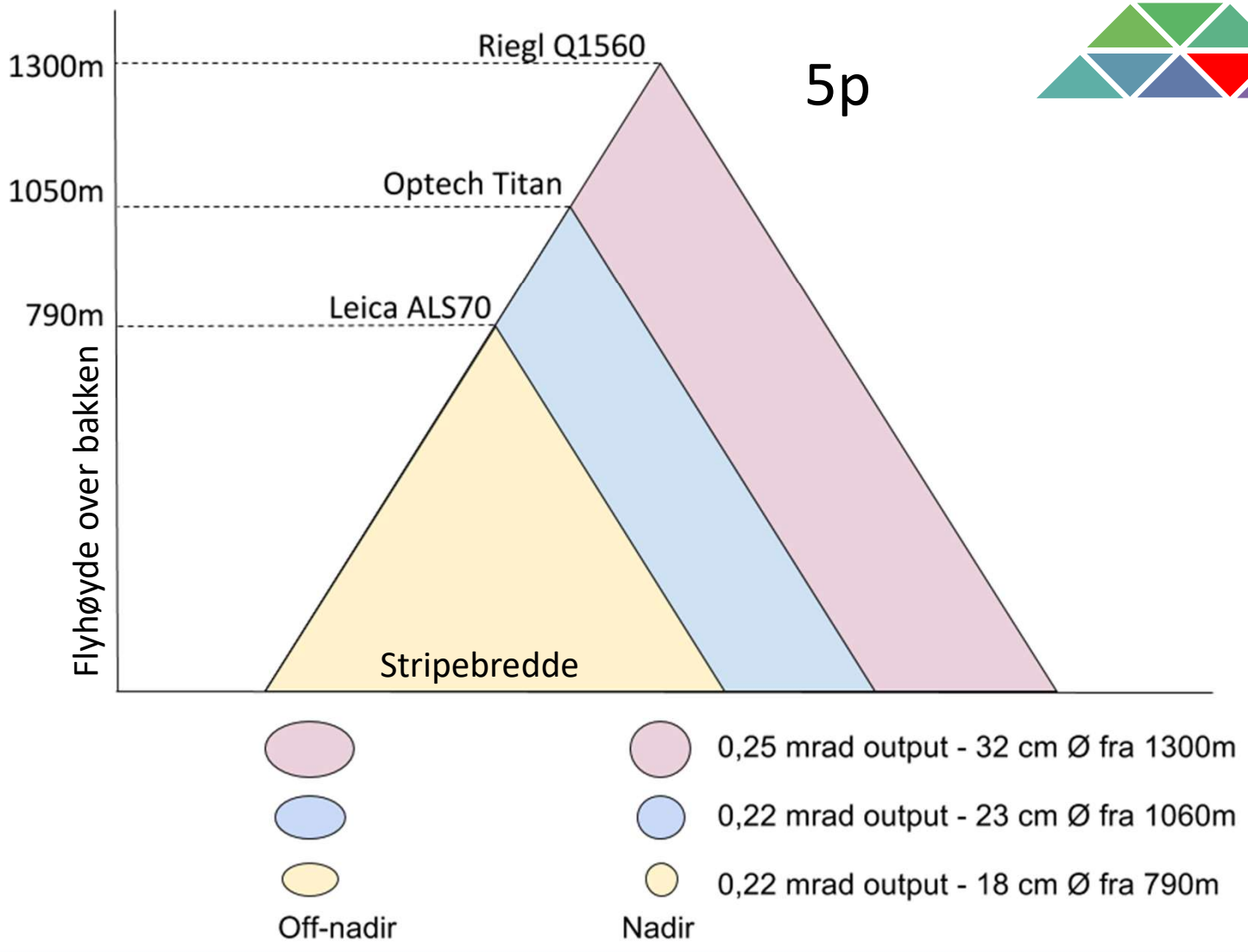


Roterende polygon

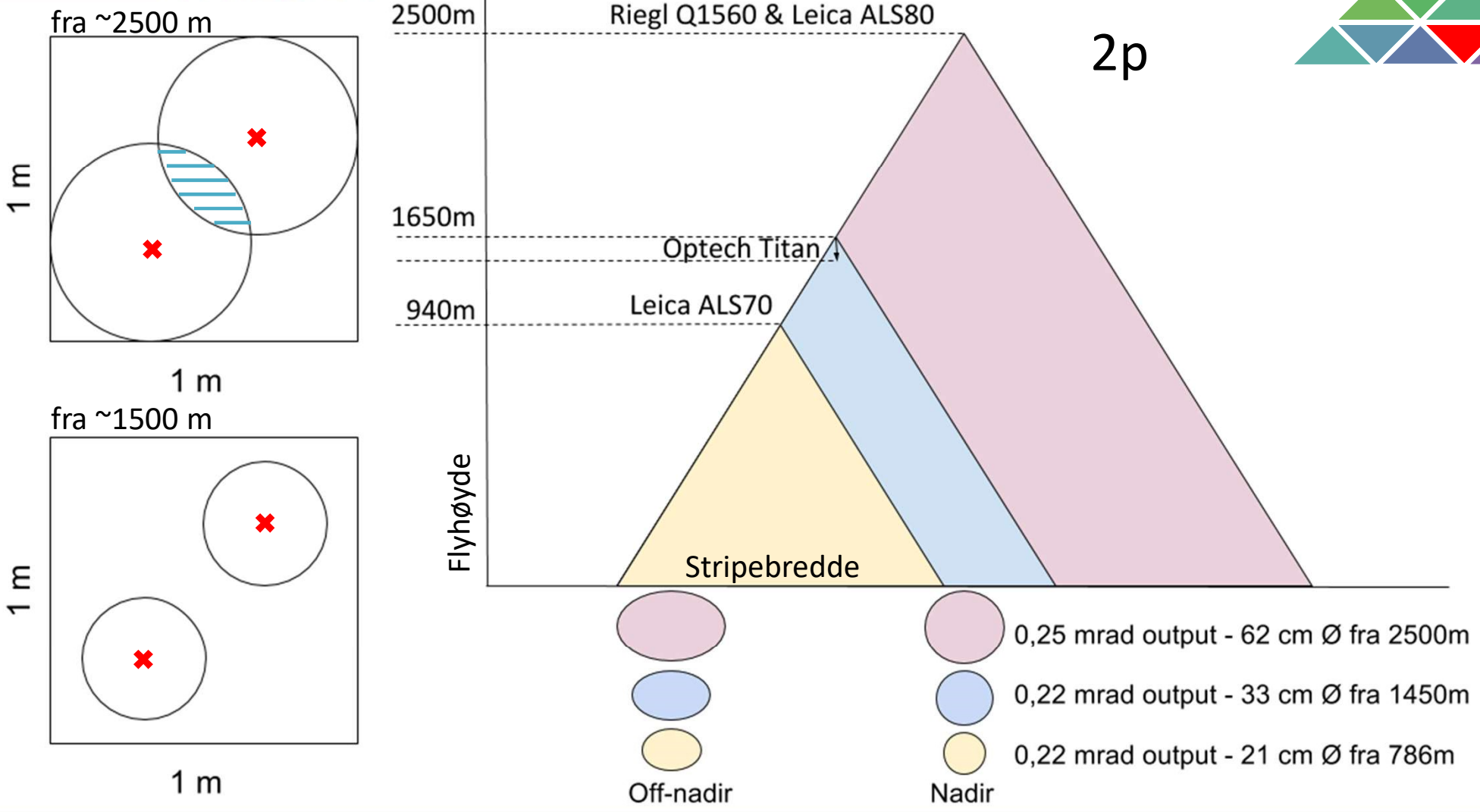




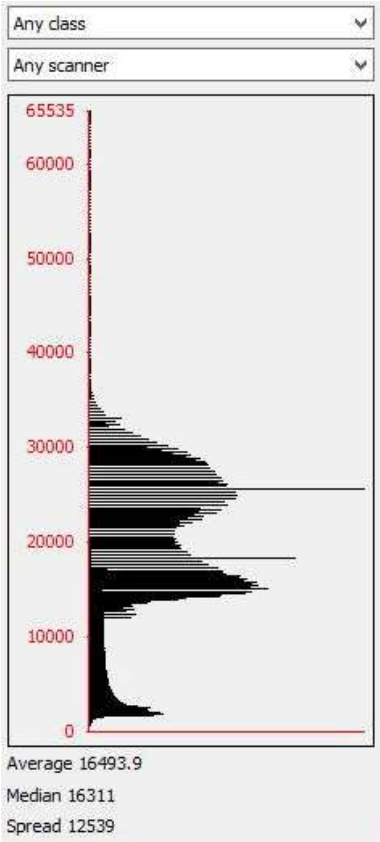

0.3 mrad
1000 m
0.3 m

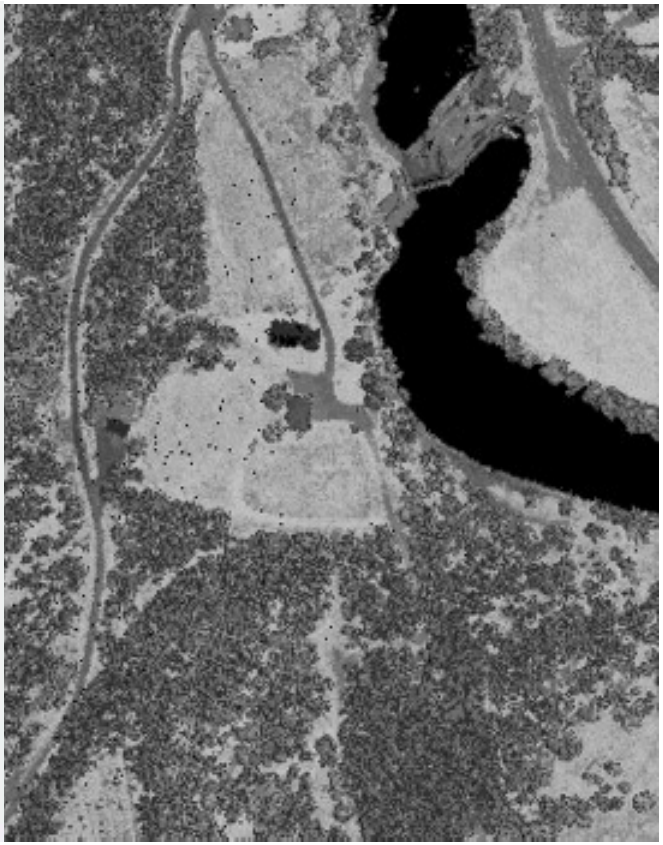

1300m
1050m
790m
Flyhøyde over bakken
Riegl Q1560
Optech Titan
Leica ALS70
Stripebredde
0,25 mrad output - 32 cm Ø fra 1300m
0,22 mrad output - 23 cm Ø fra 1060m
0,22 mrad output - 18 cm Ø fra 790m
Off-nadir
Nadir

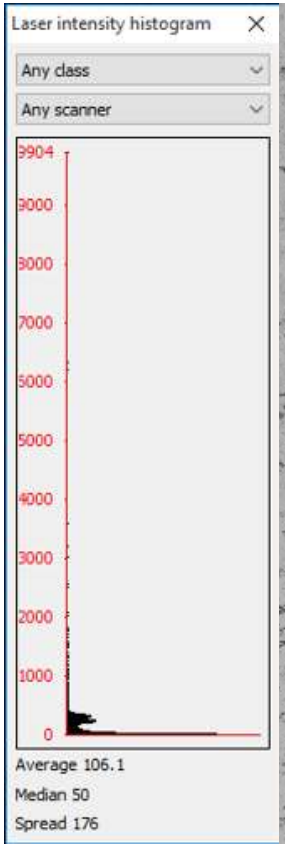
5p

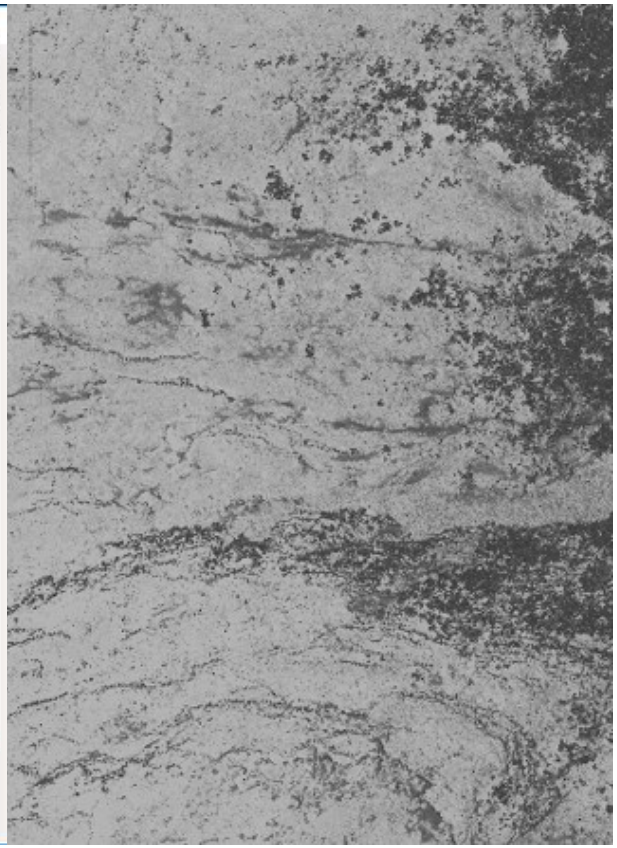

terratec
fra ~2500 m
1 m
1 m
fra ~1500 m
1 m
1 m
2500m
Riegl Q1560 & Leica ALS80
2p
1650m
Optech Titan
940m
Leica ALS70
Flyhøyde
Stripebredde
0,25 mrad output - 62 cm Ø fra 2500m
0,22 mrad output - 33 cm Ø fra 1450m
0,22 mrad output - 21 cm Ø fra 786m
Off-nadir
Nadir

Intensitet

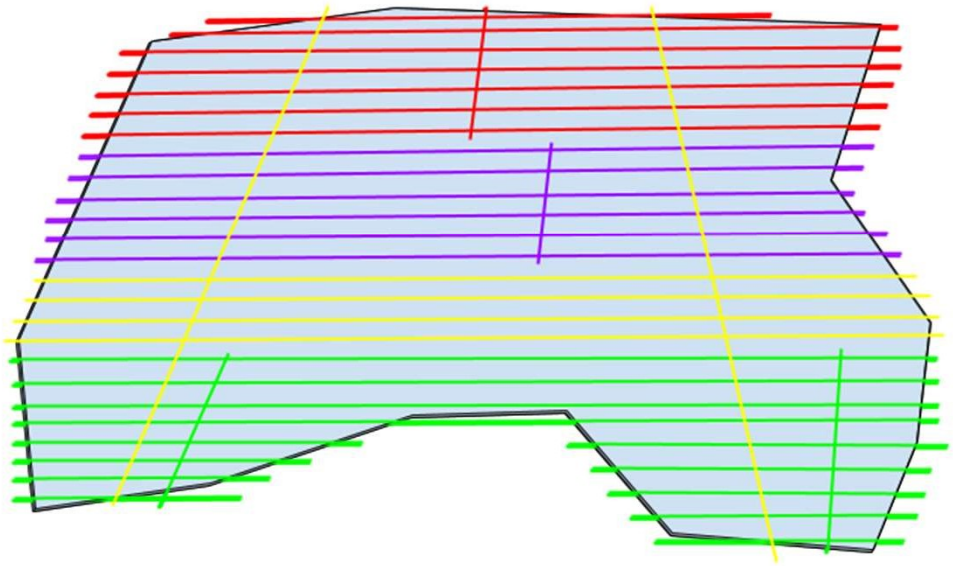

Any class
Any scanner
65535
60000
50000
40000
30000
20000
10000
0
Average 16493.9
Median 16311
Spread 12539




Laser intensity histogram
Any class
Any scanner
9904
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Average 106.1
Median 50
Spread 176



Stripejustering «matching»



Stripejustering HRPS per flydag

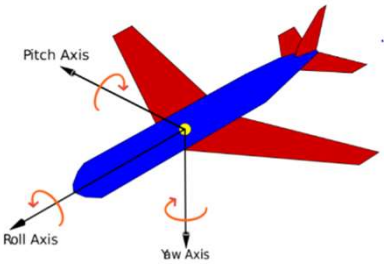
Dag1 | Dag2 | Dag3 | Dag4

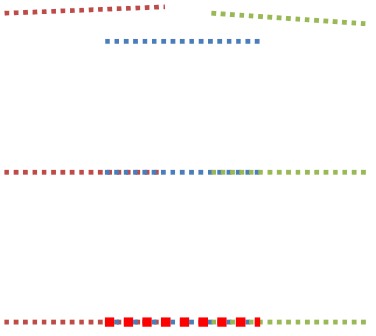
Stripejustering dZdR

Individuelle flystriper

Absolutt justering mot kontrollflater

Alle blokker

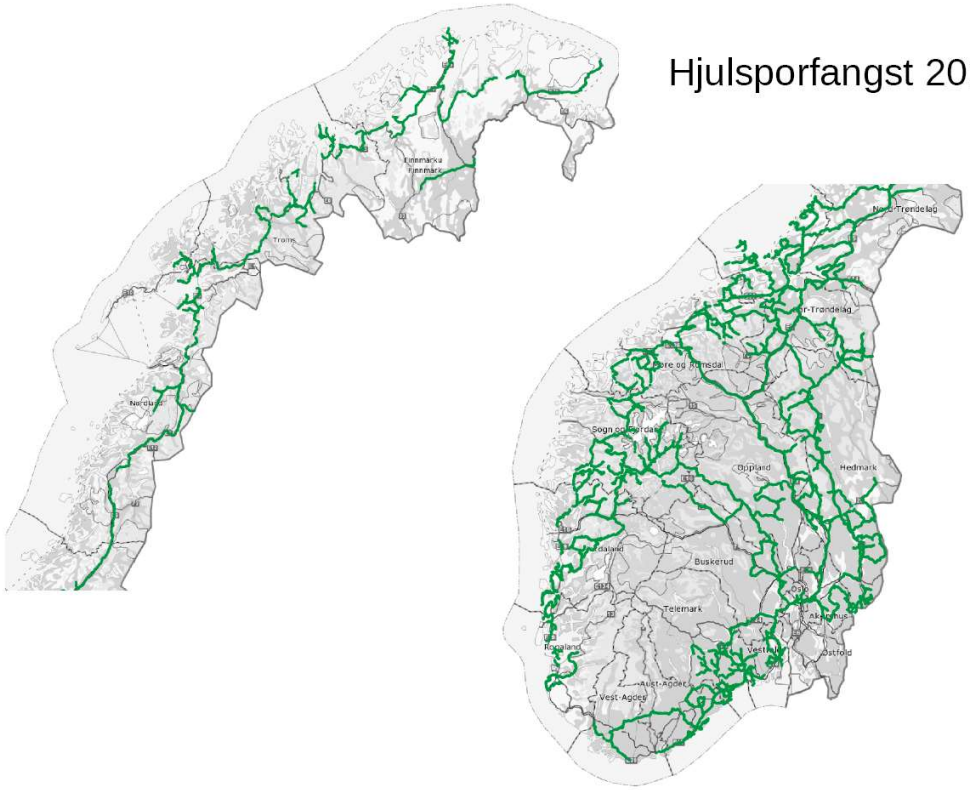




Hjulspormetode (absolutt justering)

GPS & IMU

Hjulsporfangst 2016



Klassifisering av punktsky:

Nr	Navn
1	Uklassifisert
2	Bakke
7	Støy
10	Bru
13	Snø

RGB

Klassifisering av punktsky:

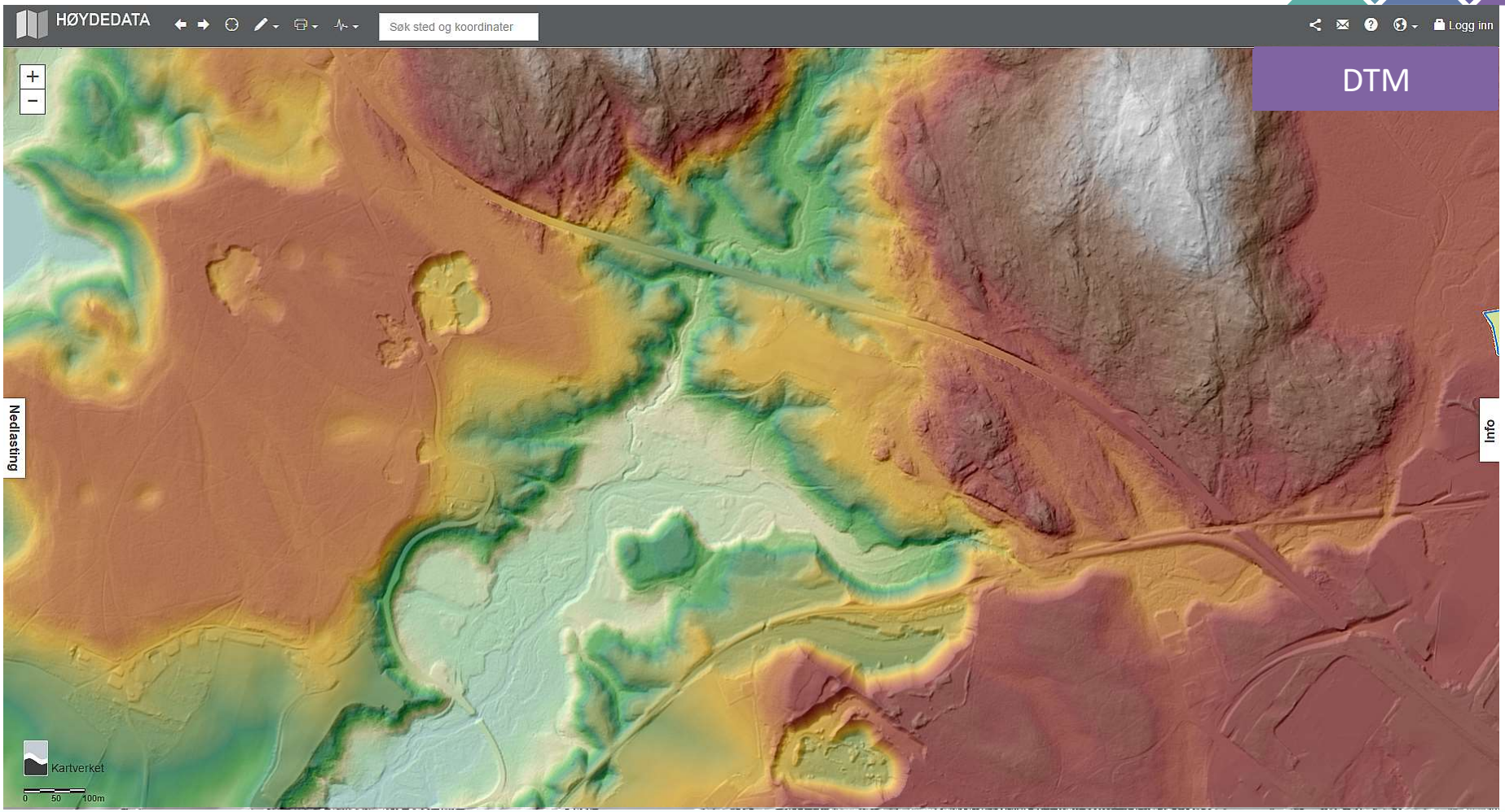
1. Svak makro – ca. 20-30% av punkter klassifisert som bakke

2. Lett makro – ca. 40-50% av punkter klassifisert som bakke

3. Normal makro – ca. 60-70% av punkter klassifisert som bakke

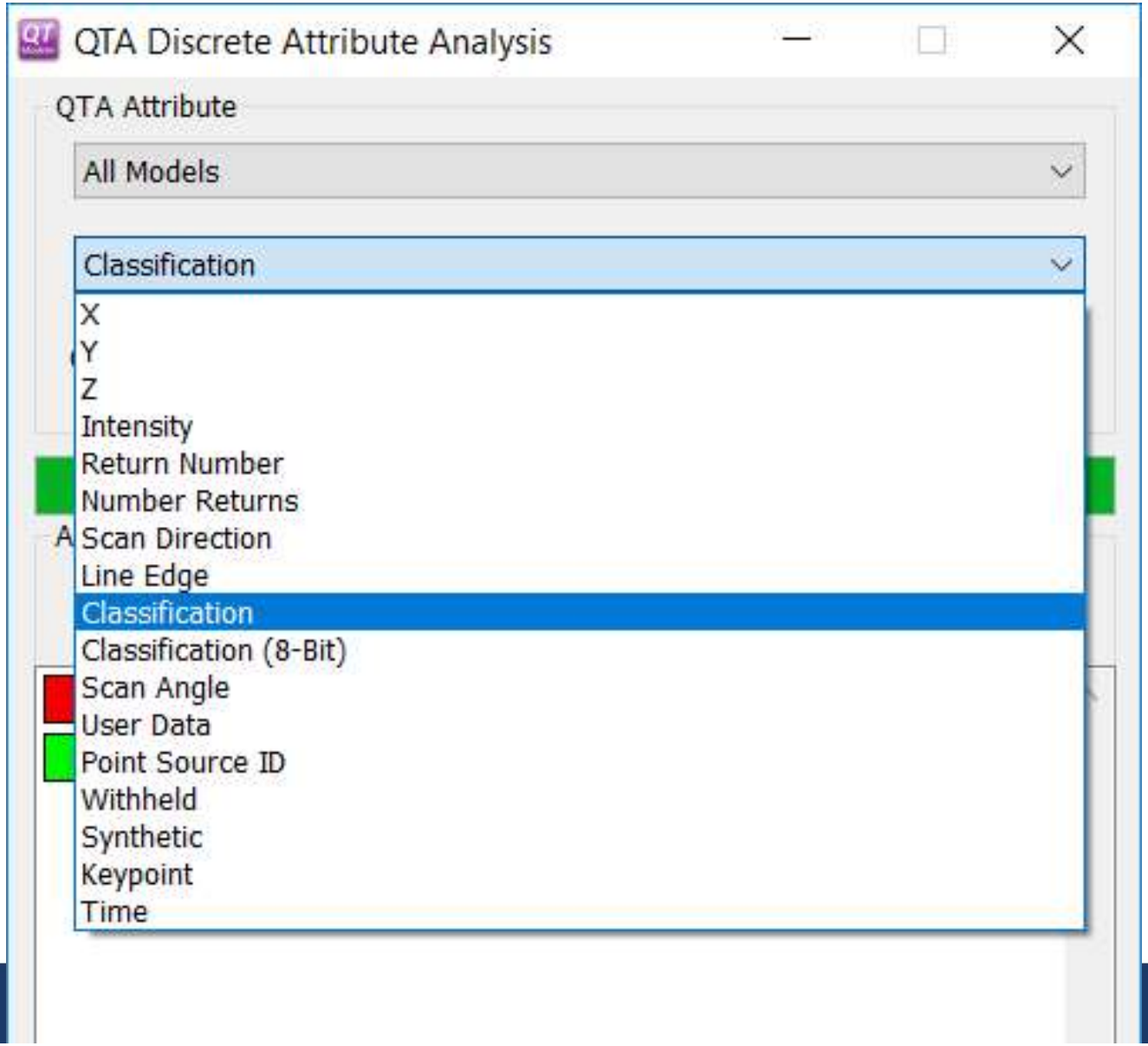
4. Sterk makro – ca. 80-90% av punkter klassifisert som bakke

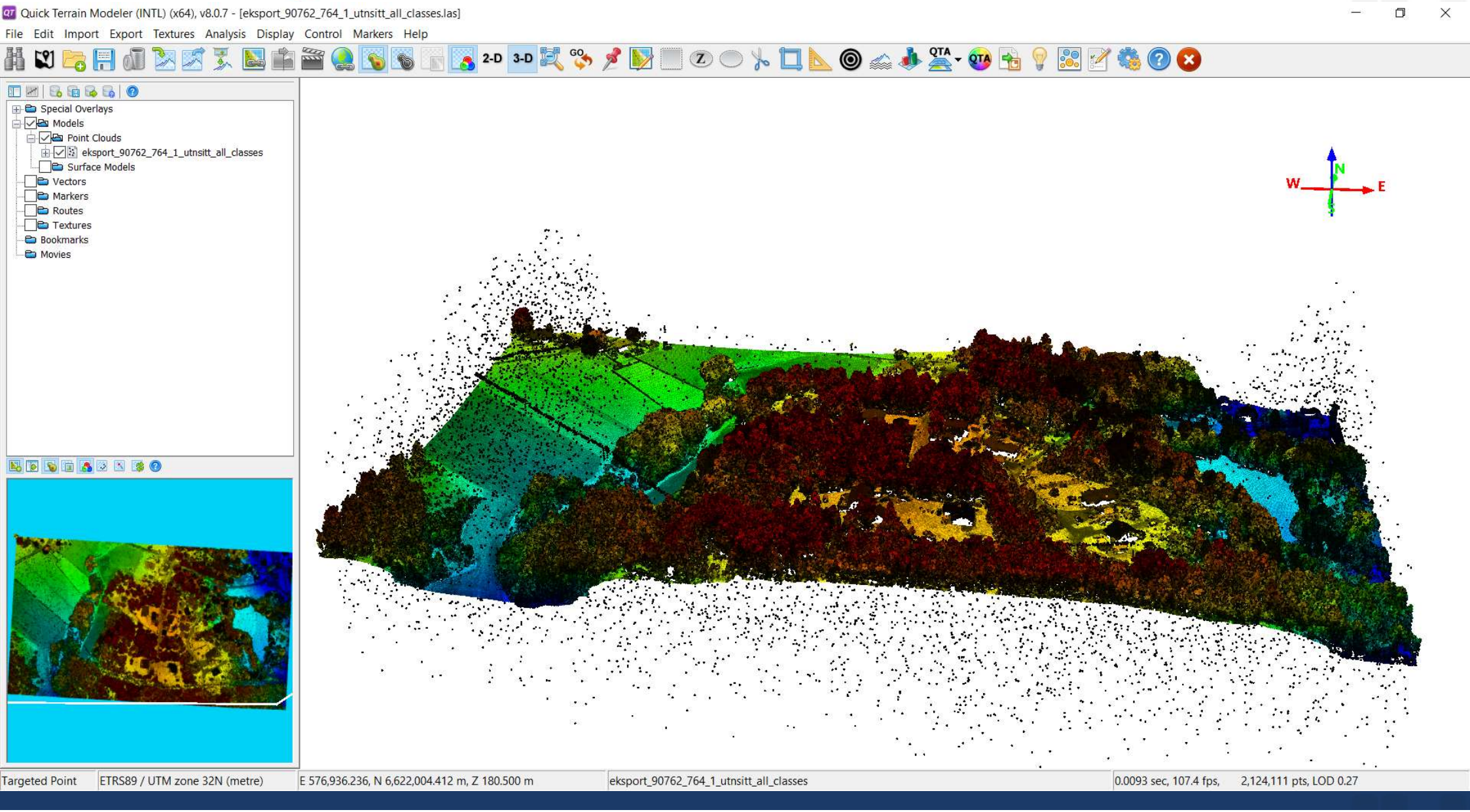
Klassifisering av punktsky:

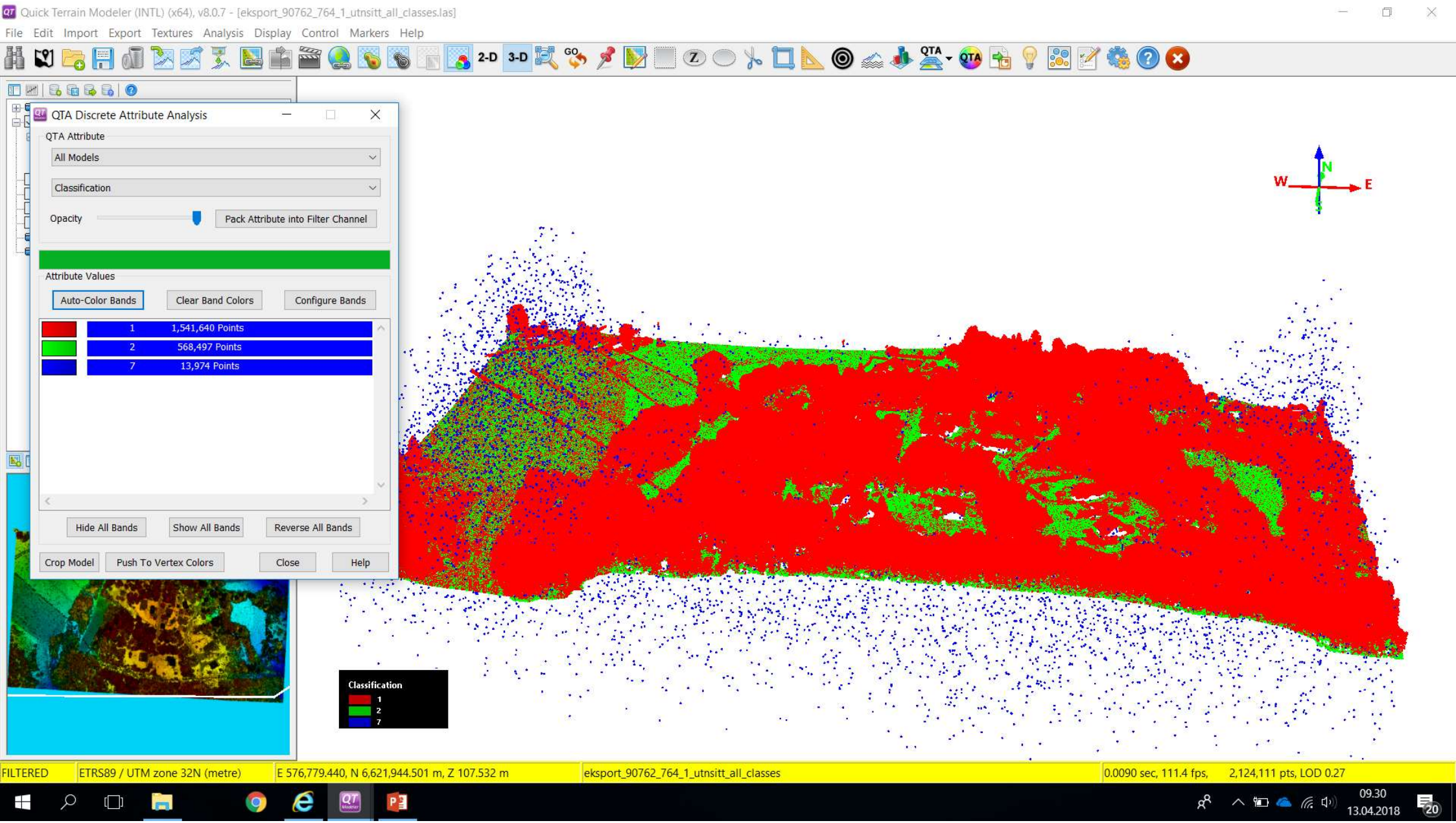

HØYDEDATA
Søk sted og koordinater
Logg inn
DTM
Nedlasting
Info
Kartverket
0 50 100m

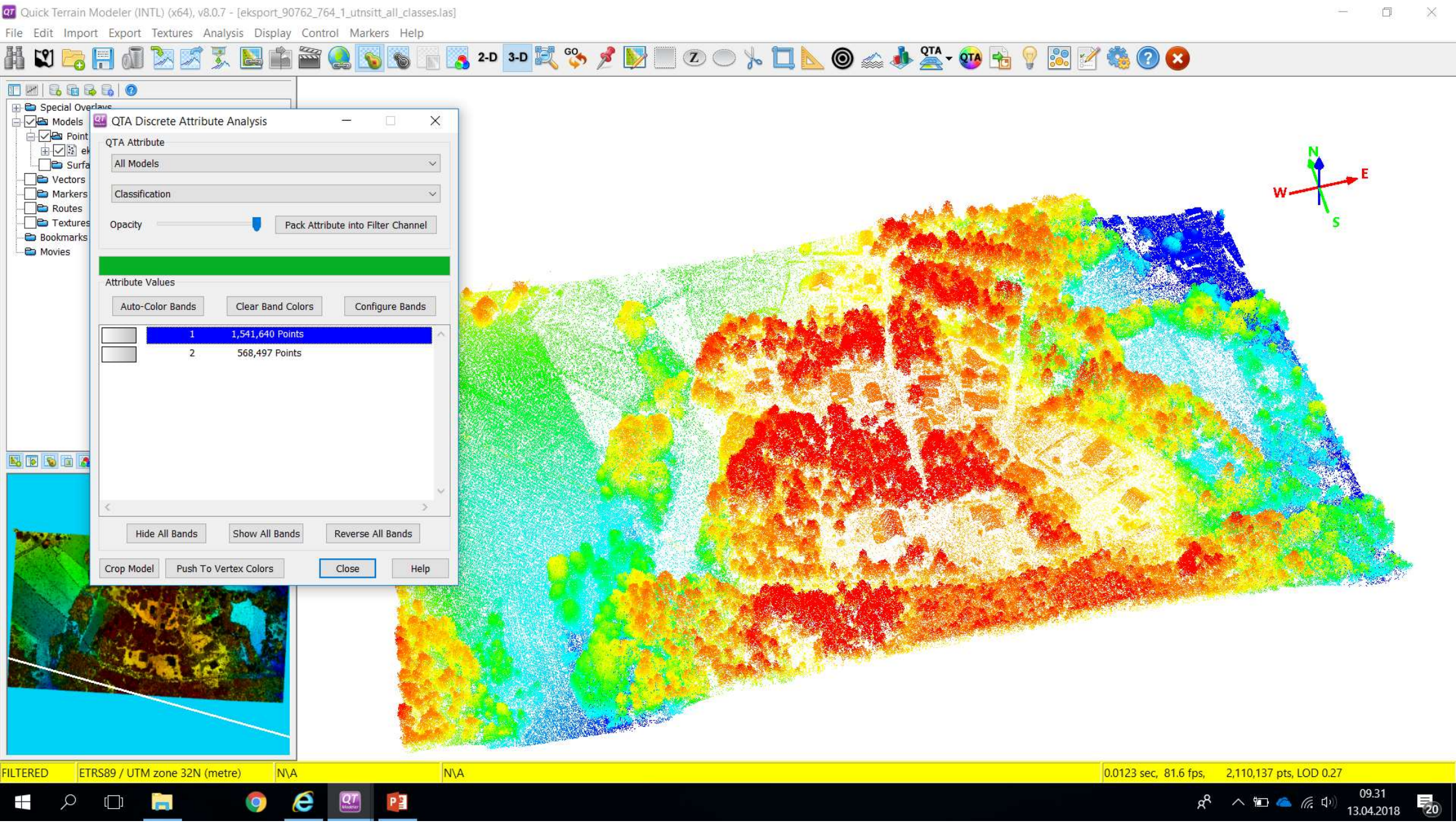
terratec

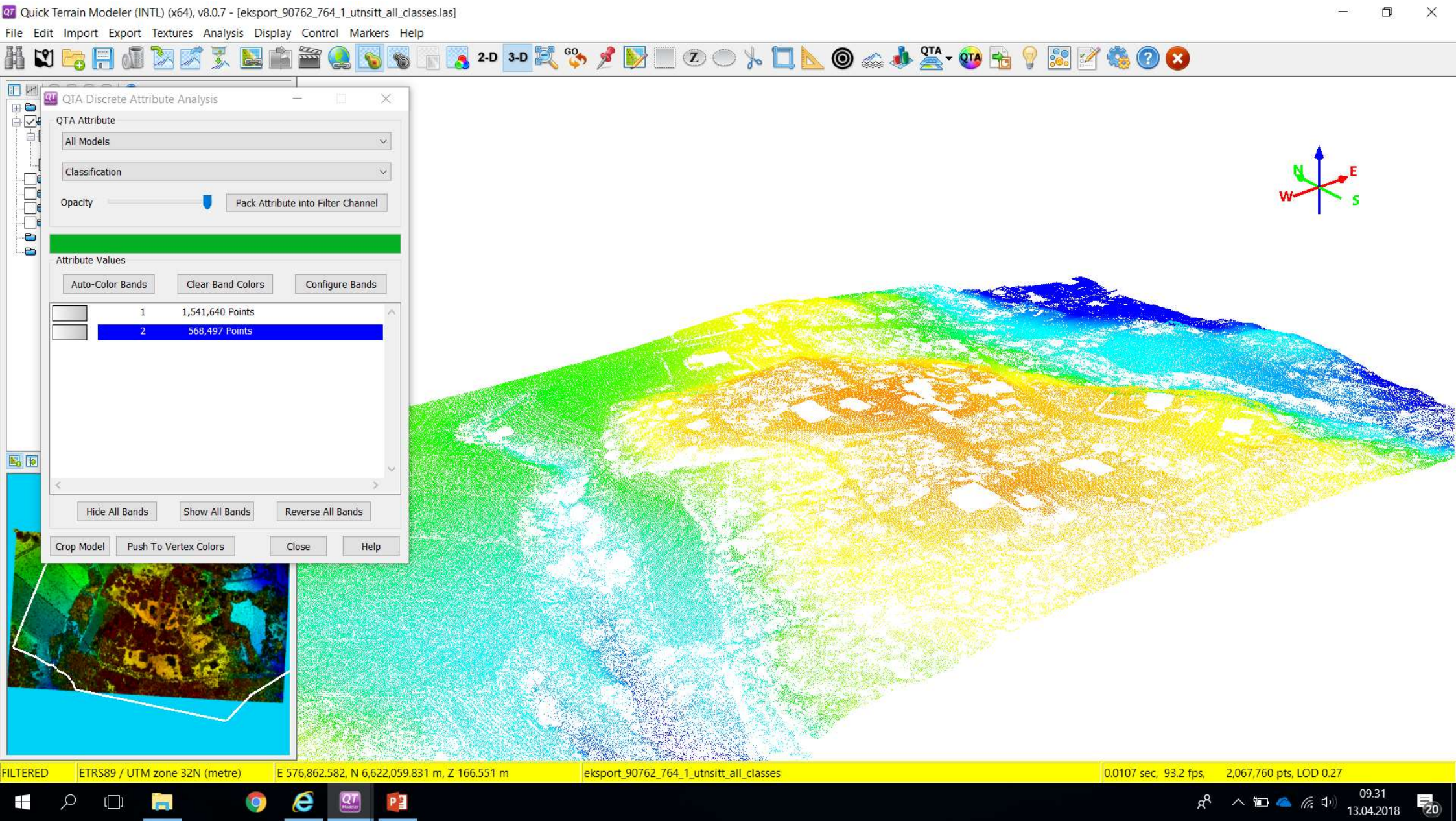
Noen eksempler «live» i Quick Terrain Modeler




Quick Terrain Modeler (INTL) (x64), v8.0.7 - [eksport_90762_764_1_utnsitt_all_classes.las]
File Edit Import Export Textures Analysis Display Control Markers Help
2-D 3-D
Special Overlays
Models
Point Clouds
eksport_90762_764_1_utnsitt_all_classes
Surface Models
Vectors
Markers
Routes
Textures
Bookmarks
Movies
N
W
E
Targeted Point
ETRS89 / UTM zone 32N (metre)
E 576,936.236, N 6,622,004.412 m, Z 180.500 m
eksport_90762_764_1_utnsitt_all_classes
0.0093 sec, 107.4 fps,
2,124,111 pts, LOD 0.27


Quick Terrain Modeler (INTL) (x64), v8.0.7 - [eksport_90762_764_1_utnsitt_all_classes.las]
File Edit Import Export Textures Analysis Display Control Markers Help
2-D 3-D
QTA Discrete Attribute Analysis
QTA Attribute
All Models
Classification
Opacity
Pack Attribute into Filter Channel
Attribute Values
Auto-Color Bands
Clear Band Colors
Configure Bands
1 1,541,640 Points
2 568,497 Points
7 13,974 Points
Hide All Bands
Show All Bands
Reverse All Bands
Crop Model
Push To Vertex Colors
Close
Help
N
W
E
Classification
1
2
7
FILTERED
ETRS89 / UTM zone 32N (metre)
E 576,779.440, N 6,621,944.501 m, Z 107.532 m
eksport_90762_764_1_utnsitt_all_classes
0.0090 sec, 111.4 fps,
2,124,111 pts, LOD 0.27
09.30
13.04.2018


Quick Terrain Modeler (INTL) (x64), v8.0.7 - [eksport_90762_764_1_utnsitt_all_classes.las]
File Edit Import Export Textures Analysis Display Control Markers Help
2-D 3-D GO QTA
Special Overlays
Models
Point
Surfa
Vectors
Markers
Routes
Textures
Bookmarks
Movies
QTA Discrete Attribute Analysis
QTA Attribute
All Models
Classification
Opacity
Pack Attribute into Filter Channel
Attribute Values
Auto-Color Bands
Clear Band Colors
Configure Bands
1 1,541,640 Points
2 568,497 Points
Hide All Bands
Show All Bands
Reverse All Bands
Crop Model
Push To Vertex Colors
Close
Help
N
E
W
S
FILTERED
ETRS89 / UTM zone 32N (metre)
N\A
N\A
0.0123 sec, 81.6 fps, 2,110,137 pts, LOD 0.27
09.31
13.04.2018

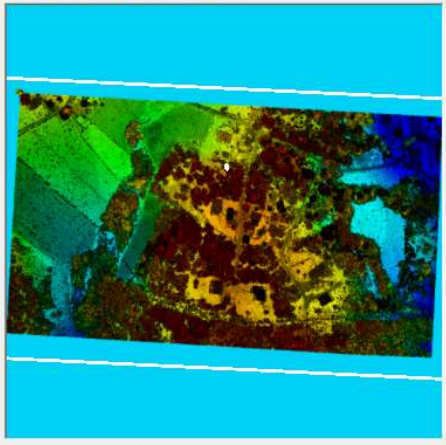

Quick Terrain Modeler (INTL) (x64), v8.0.7 - [eksport_90762_764_1_utnsitt_all_classes.las]
File Edit Import Export Textures Analysis Display Control Markers Help
2-D 3-D
QTA Discrete Attribute Analysis
QTA Attribute
All Models
Classification
Opacity
Pack Attribute into Filter Channel
Attribute Values
Auto-Color Bands
Clear Band Colors
Configure Bands
1 1,541,640 Points
2 568,497 Points
Hide All Bands
Show All Bands
Reverse All Bands
Crop Model
Push To Vertex Colors
Close
Help
N
E
W
S
FILTERED
ETRS89 / UTM zone 32N (metre)
E 576,862.582, N 6,622,059.831 m, Z 166.551 m
eksport_90762_764_1_utnsitt_all_classes
0.0107 sec, 93.2 fps, 2,067,760 pts, LOD 0.27
09.31
13.04.2018

Quick Terrain Modeler (INTL) (x64), v8.0.7 - [eksport_90762_764_1_utnsitt_all_classes.las]

File Edit Import Export Textures Analysis Display Control Markers Help

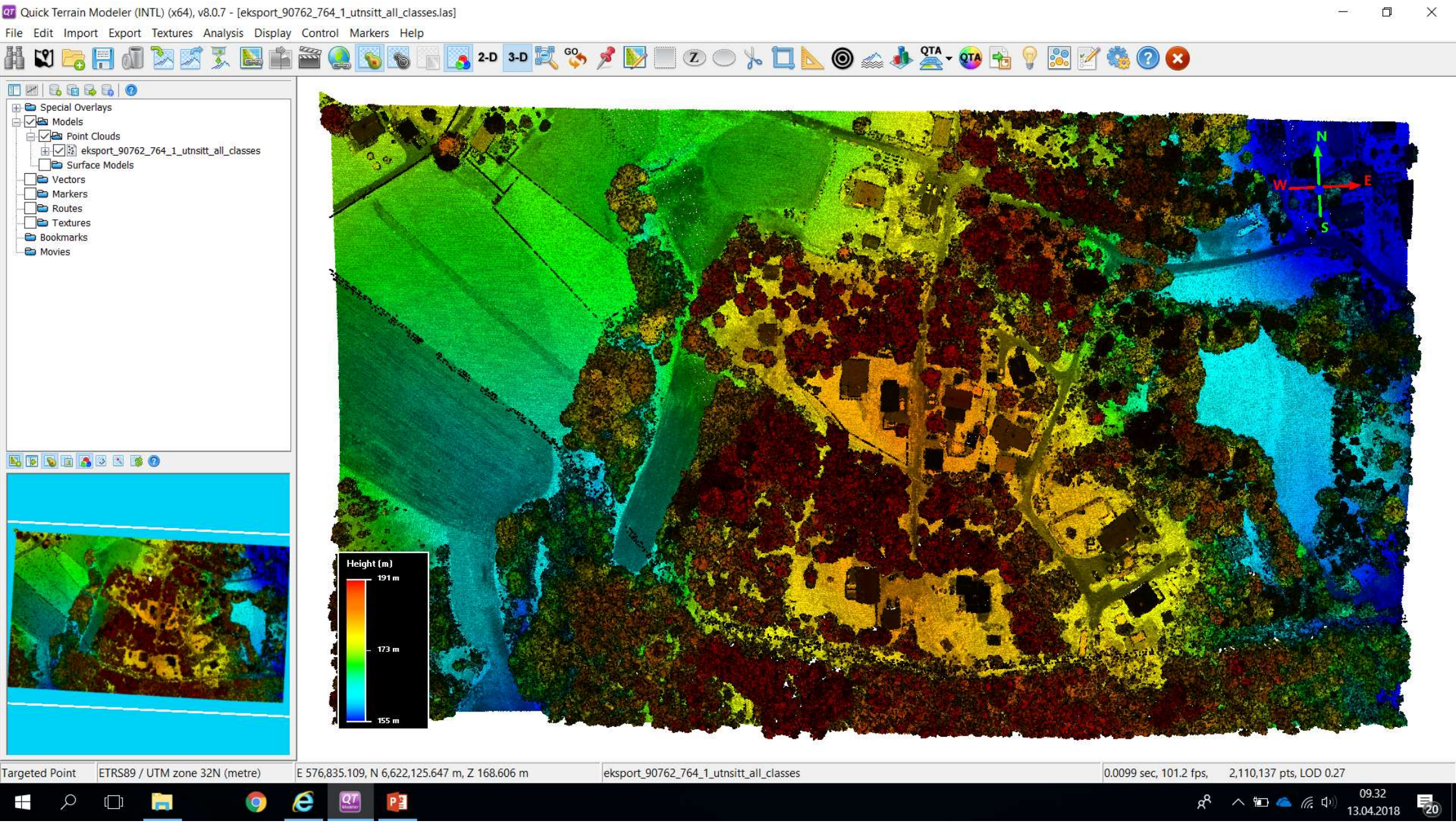
2-D 3-D GO QTA QTA

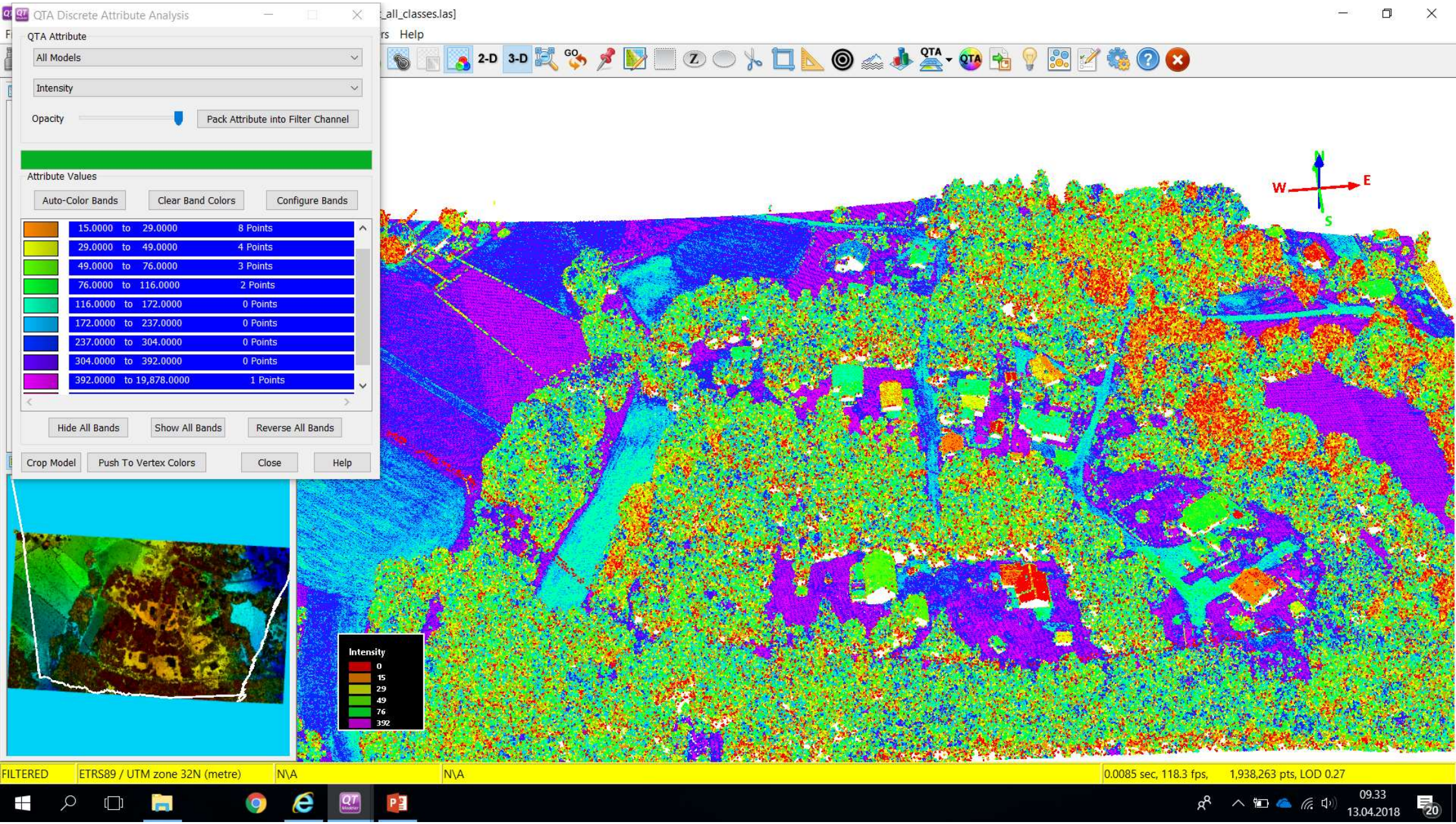
- Special Overlays
- Models
  - Point Clouds
    - eksport_90762_764_1_utnsitt_all_classes
  - Surface Models
- Vectors
- Markers
- Routes
- Textures
- Bookmarks
- Movies

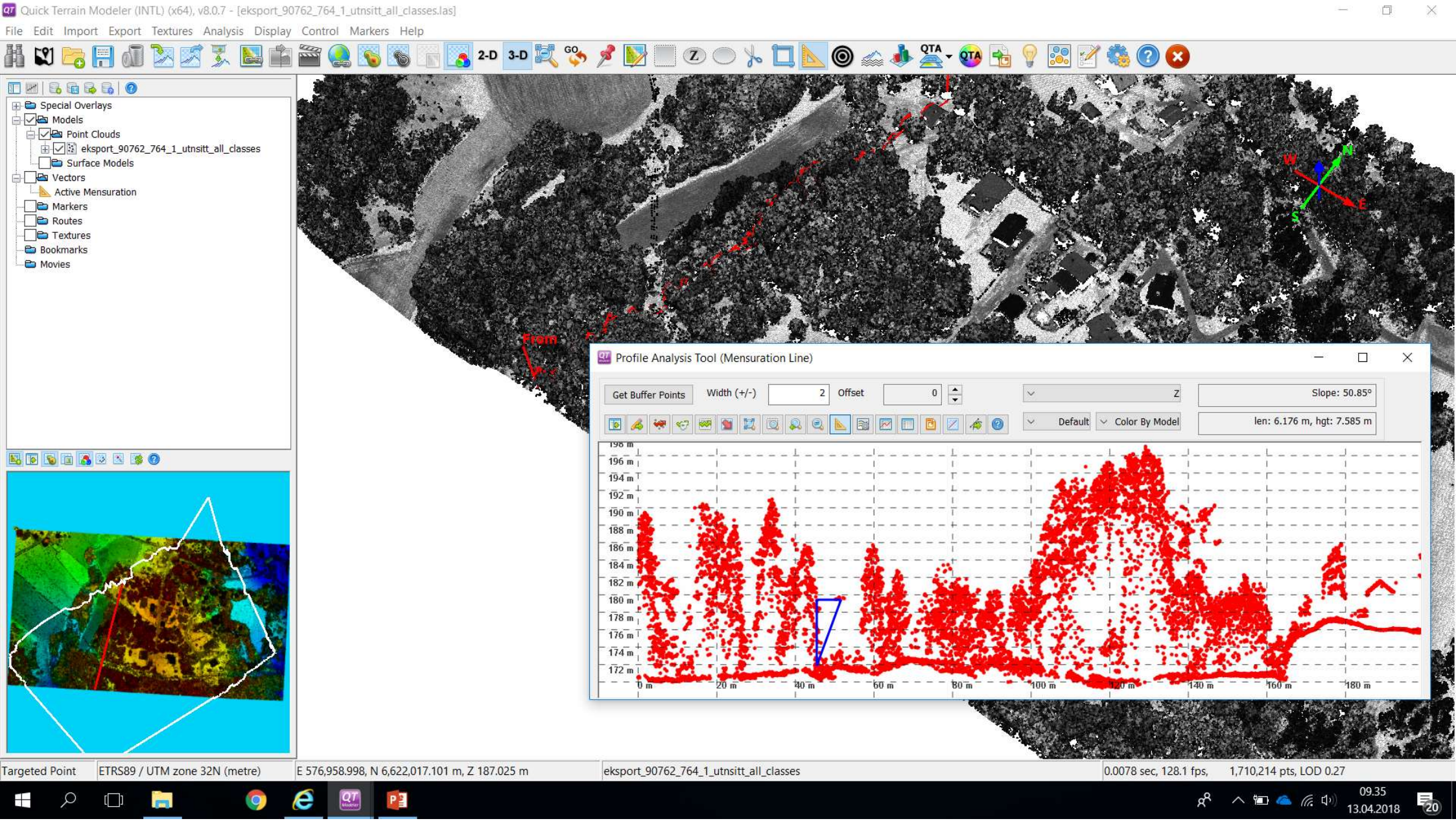


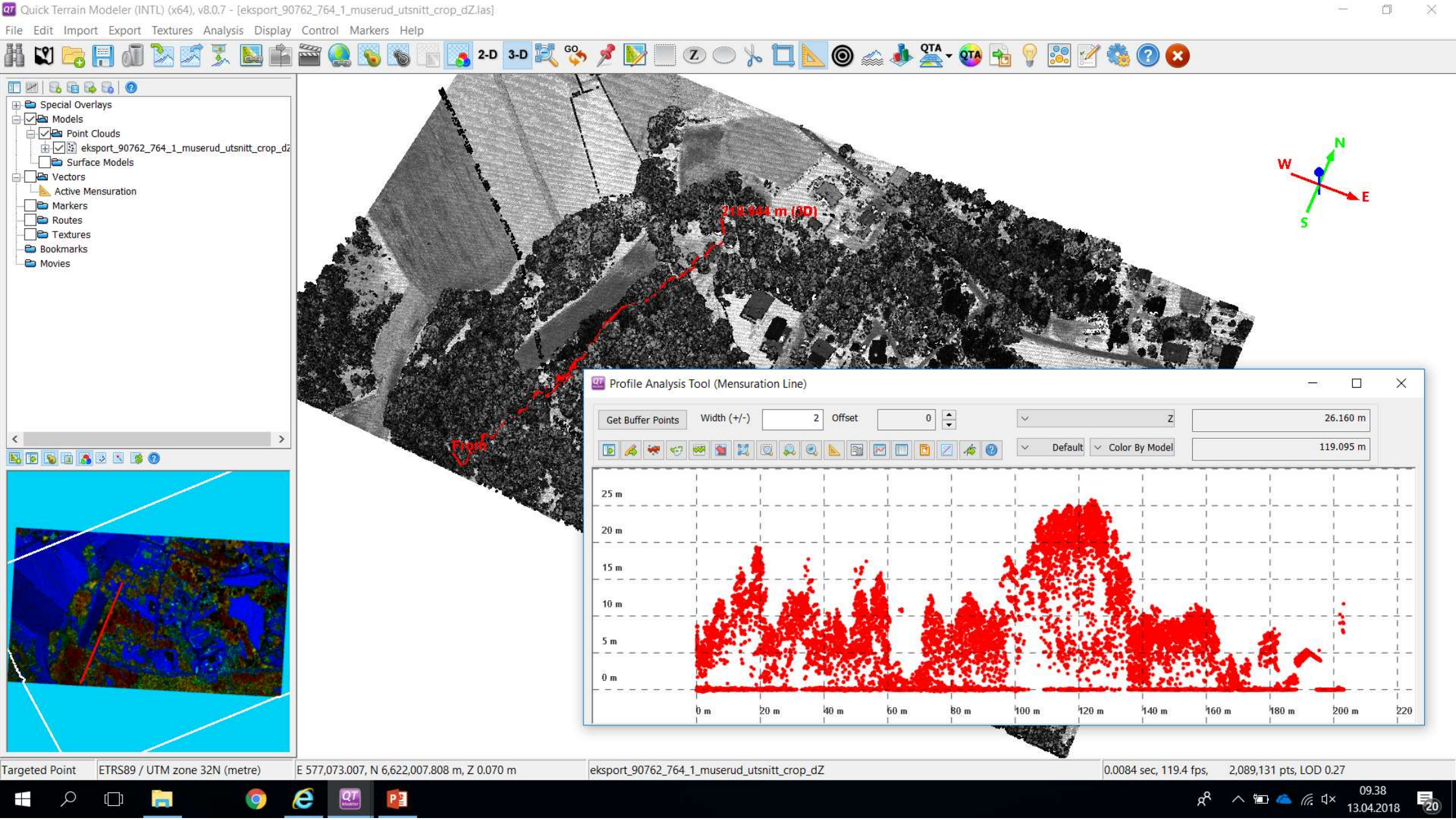
Targeted Point | ETRS89 / UTM zone 32N (metre) | N\A | N\A | 0.0102 sec, 97.7 fps, 2,110,137 pts, LOD 0.27

09.32
13.04.2018


Quick Terrain Modeler (INTL) (x64), v8.0.7 - [eksport_90762_764_1_utnsitt_all_classes.las]
File Edit Import Export Textures Analysis Display Control Markers Help
2-D 3-D
Special Overlays
Models
Point Clouds
eksport_90762_764_1_utnsitt_all_classes
Surface Models
Vectors
Markers
Routes
Textures
Bookmarks
Movies
N
W
E
S
Height (m)
191 m
173 m
155 m
Targeted Point
ETRS89 / UTM zone 32N (metre)
E 576,835.109, N 6,622,125.647 m, Z 168.606 m
eksport_90762_764_1_utnsitt_all_classes
0.0099 sec, 101.2 fps,
2,110,137 pts, LOD 0.27
09.32
13.04.2018


QTA Discrete Attribute Analysis
QTA Attribute
All Models
Intensity
Opacity
Pack Attribute into Filter Channel
Attribute Values
Auto-Color Bands
Clear Band Colors
Configure Bands
15.0000 to 29.0000 8 Points
29.0000 to 49.0000 4 Points
49.0000 to 76.0000 3 Points
76.0000 to 116.0000 2 Points
116.0000 to 172.0000 0 Points
172.0000 to 237.0000 0 Points
237.0000 to 304.0000 0 Points
304.0000 to 392.0000 0 Points
392.0000 to 19,878.0000 1 Points
Hide All Bands
Show All Bands
Reverse All Bands
Crop Model
Push To Vertex Colors
Close
Help
Intensity
0
15
29
49
76
392
W
E
S
FILTERED
ETRS89 / UTM zone 32N (metre)
N\A
N\A
0.0085 sec, 118.3 fps, 1,938,263 pts, LOD 0.27
09.33
13.04.2018


Quick Terrain Modeler (INTL) (x64), v8.0.7 - [eksport_90762_764_1_utnsitt_all_classes.las]
File Edit Import Export Textures Analysis Display Control Markers Help
2-D 3-D
Special Overlays
Models
Point Clouds
eksport_90762_764_1_utnsitt_all_classes
Surface Models
Vectors
Active Mensuration
Markers
Routes
Textures
Bookmarks
Movies
From
Profile Analysis Tool (Mensuration Line)
Get Buffer Points
Width (+/-)
2
Offset
0
Z
Slope: 50.85°
Default
Color By Model
len: 6.176 m, hgt: 7.585 m
198 m
196 m
194 m
192 m
190 m
188 m
186 m
184 m
182 m
180 m
178 m
176 m
174 m
172 m
0 m
20 m
40 m
60 m
80 m
100 m
120 m
140 m
160 m
180 m
N
W
E
S
Targeted Point
ETRS89 / UTM zone 32N (metre)
E 576,958.998, N 6,622,017.101 m, Z 187.025 m
eksport_90762_764_1_utnsitt_all_classes
0.0078 sec, 128.1 fps,
1,710,214 pts, LOD 0.27
09.35
13.04.2018

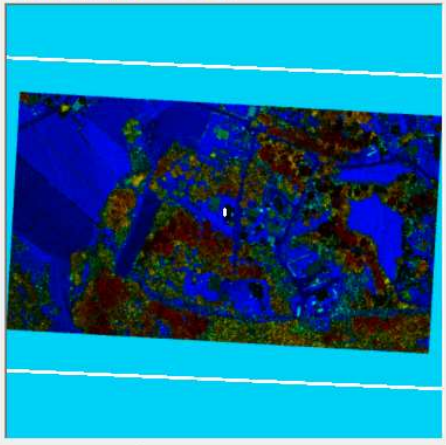

Quick Terrain Modeler (INTL) (x64), v8.0.7 - [eksport_90762_764_1_muserud_utsnitt_crop_dZ.las]
File Edit Import Export Textures Analysis Display Control Markers Help
2-D 3-D
Special Overlays
Models
Point Clouds
eksport_90762_764_1_muserud_utsnitt_crop_dz
Surface Models
Vectors
Active Mensuration
Markers
Routes
Textures
Bookmarks
Movies
N
W
E
S
Profile Analysis Tool (Mensuration Line)
Get Buffer Points
Width (+/-)
2
Offset
0
Z
26.160 m
Default
Color By Model
119.095 m
25 m
20 m
15 m
10 m
5 m
0 m
0 m
20 m
40 m
60 m
80 m
100 m
120 m
140 m
160 m
180 m
200 m
220
Targeted Point
ETRS89 / UTM zone 32N (metre)
E 577,073.007, N 6,622,007.808 m, Z 0.070 m
eksport_90762_764_1_muserud_utsnitt_crop_dZ
0.0084 sec, 119.4 fps,
2,089,131 pts, LOD 0.27
09.38
13.04.2018

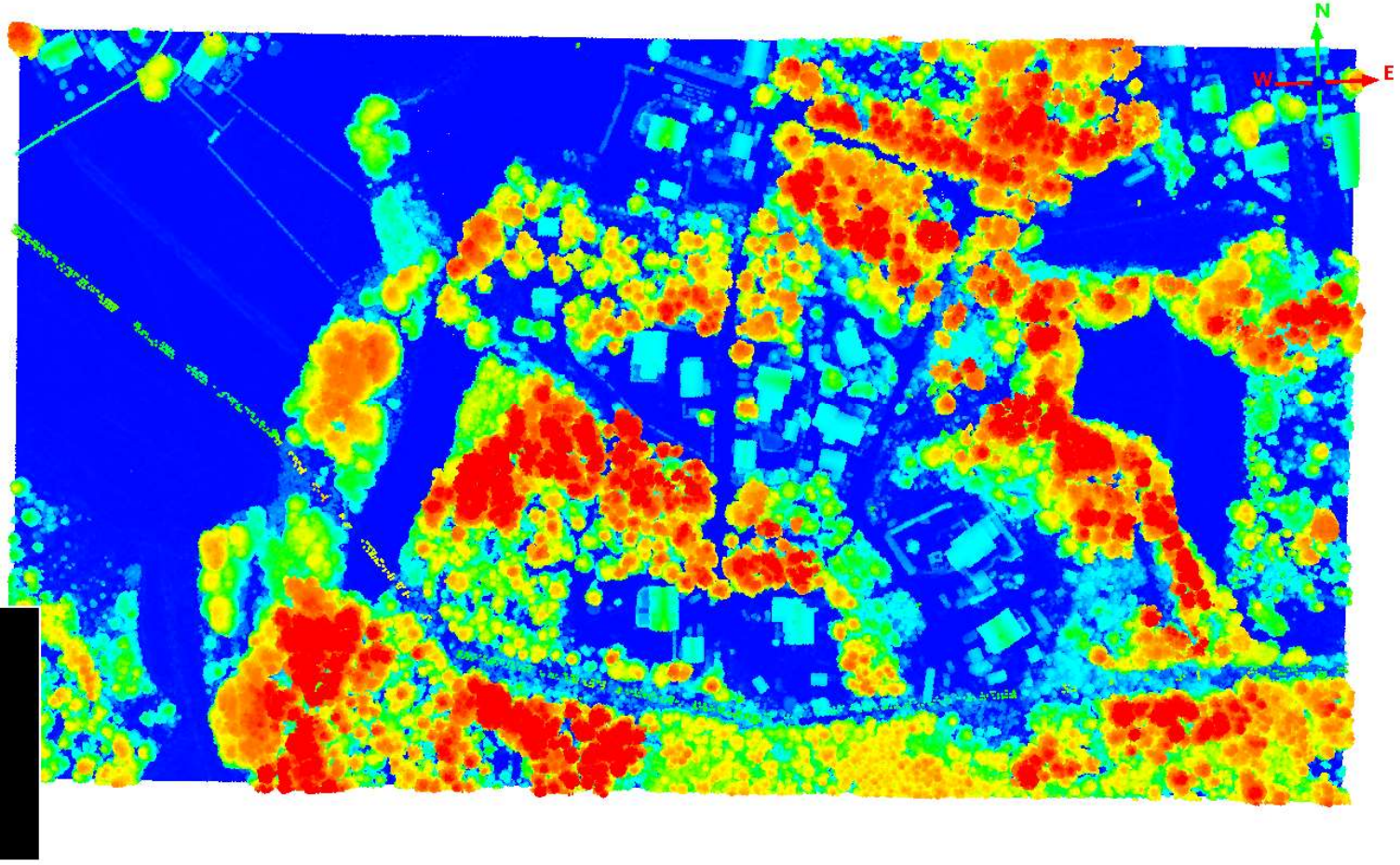
Quick Terrain Modeler (INTL) (x64), v8.0.7 - [eksport_90762_764_1_muserud_utsnitt_crop_dZ.las]

File Edit Import Export Textures Analysis Display Control Markers Help

2-D 3-D

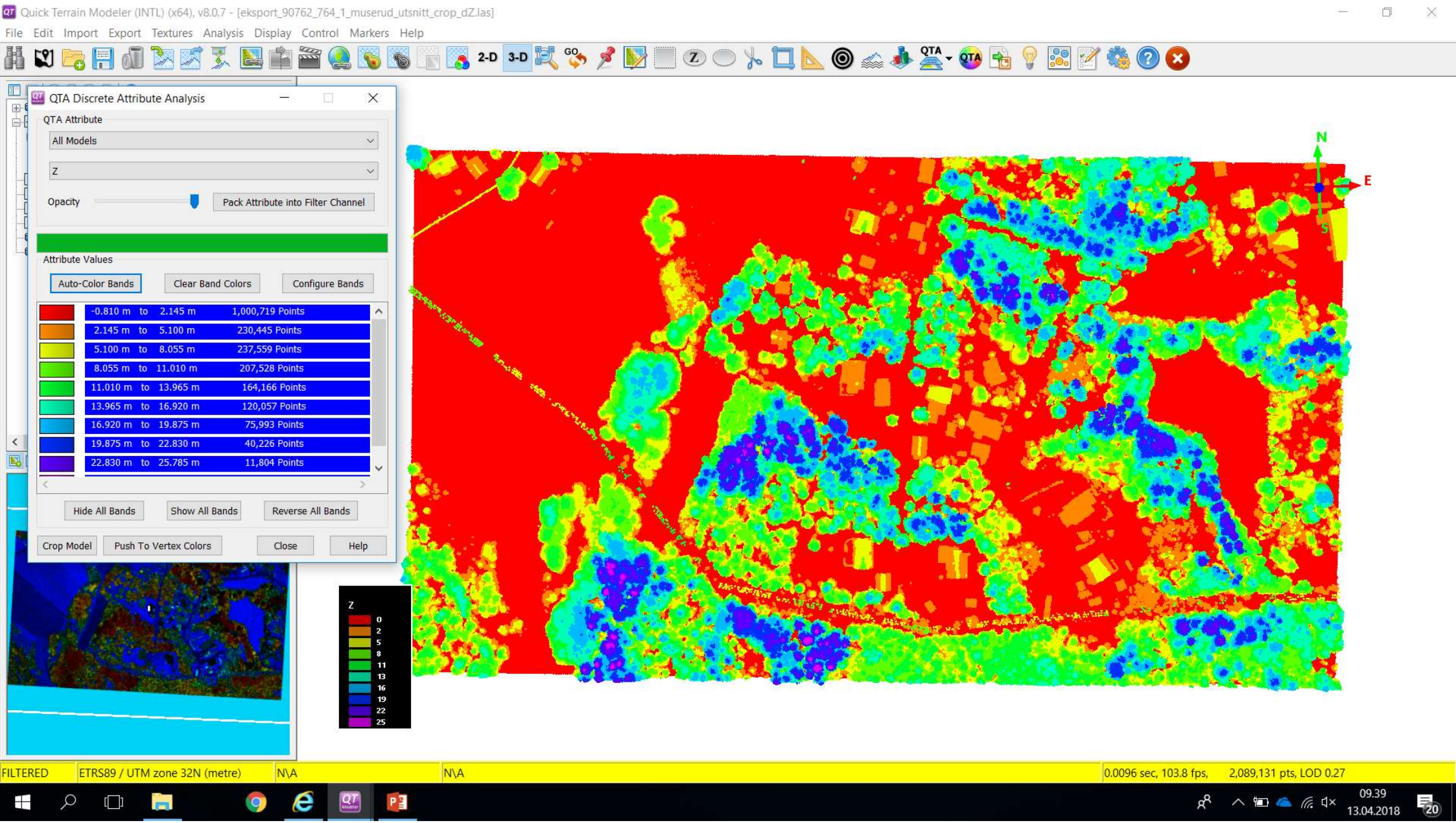
- Special Overlays
- Models
  - Point Clouds
    - eksport_90762_764_1_muserud_utsnitt_crop_dZ
  - Surface Models
- Vectors
- Markers
- Routes
- Textures
- Bookmarks
- Movies

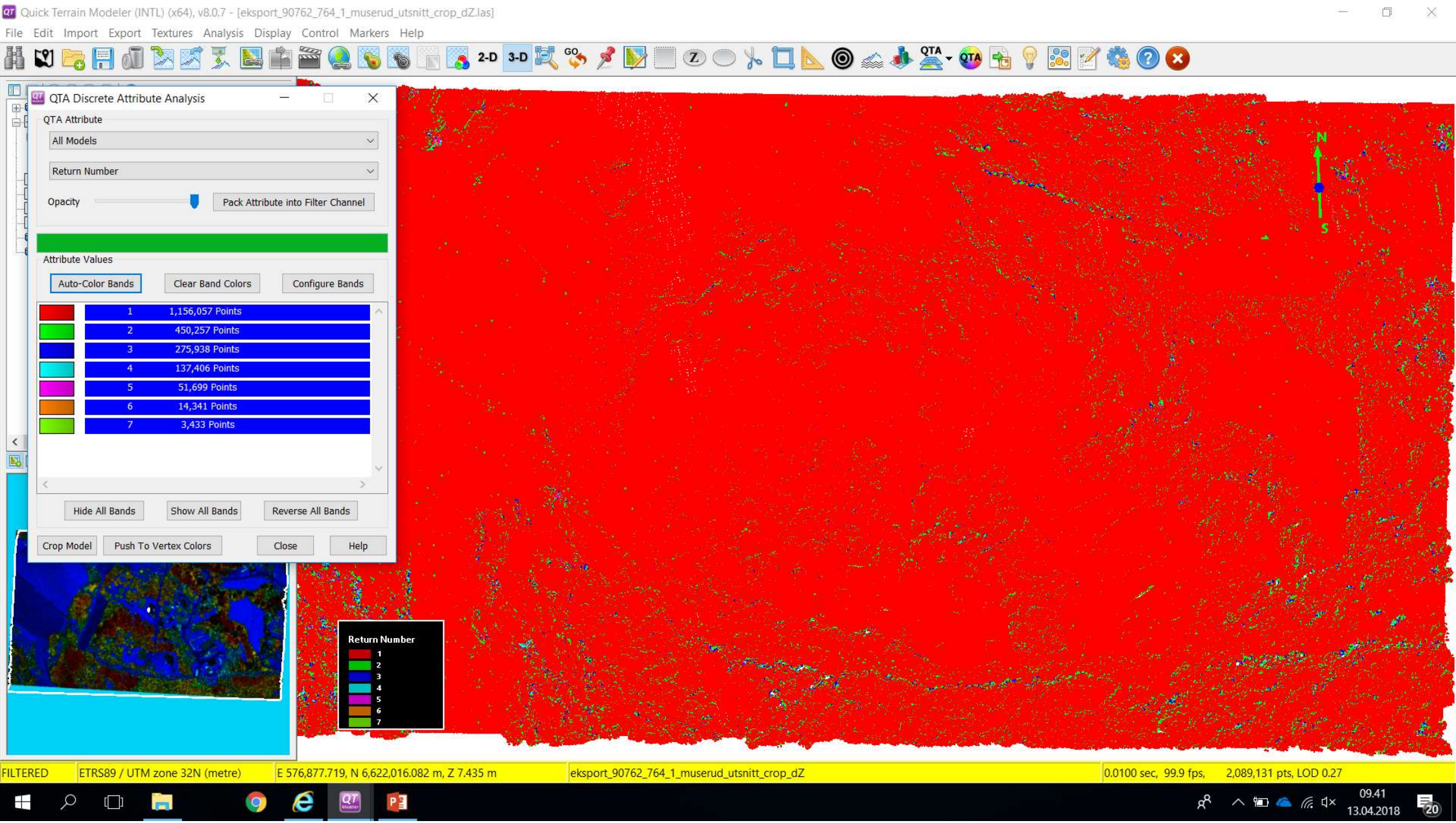


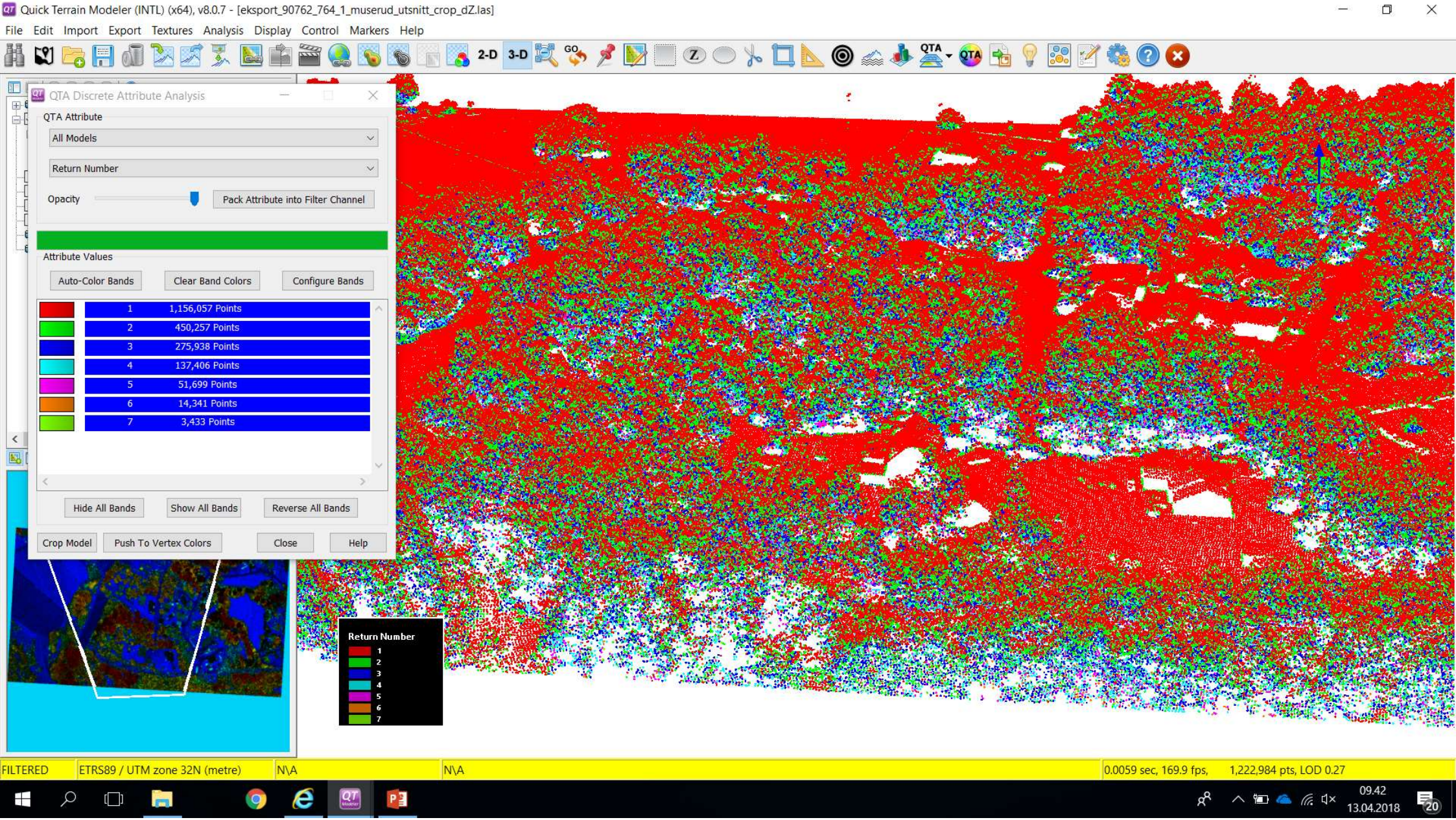


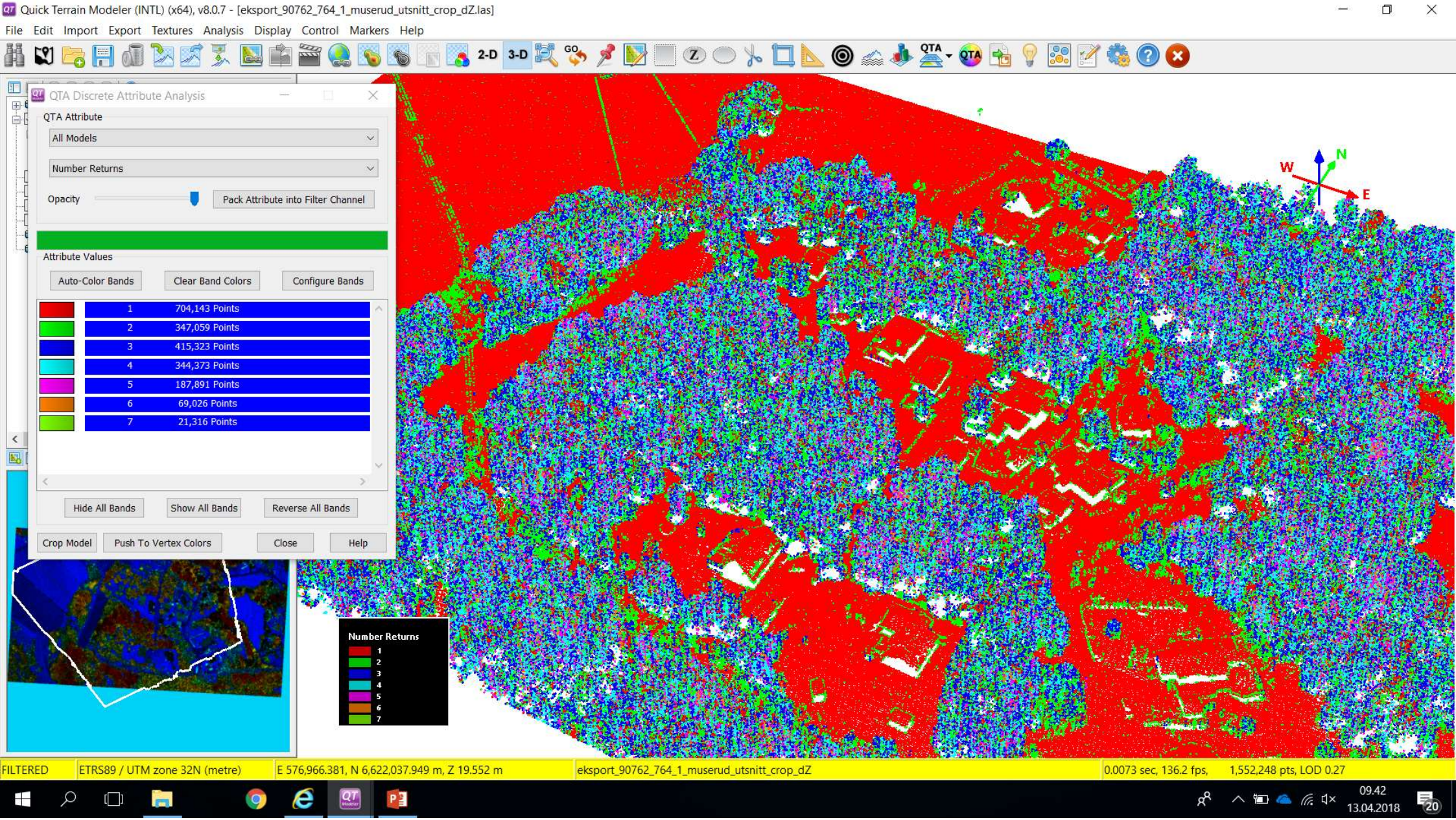
Targeted Point | ETRS89 / UTM zone 32N (metre) | E 576,894.085, N 6,622,069.817 m, Z 10.037 m | eksport_90762_764_1_muserud_utsnitt_crop_dZ | 0.0926 sec, 10.8 fps, 2,089,131 pts, LOD 0.27

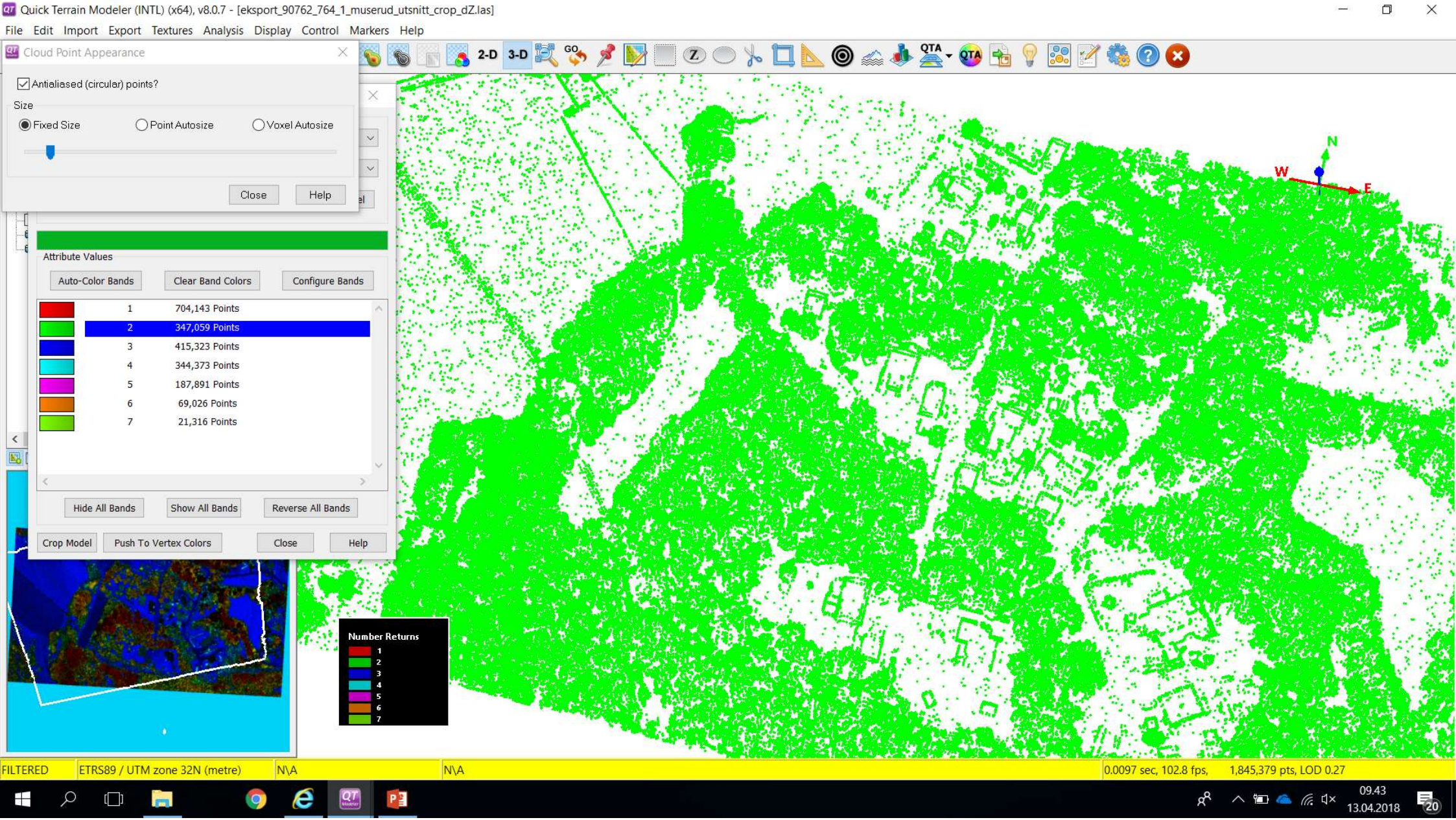
09.39
13.04.2018

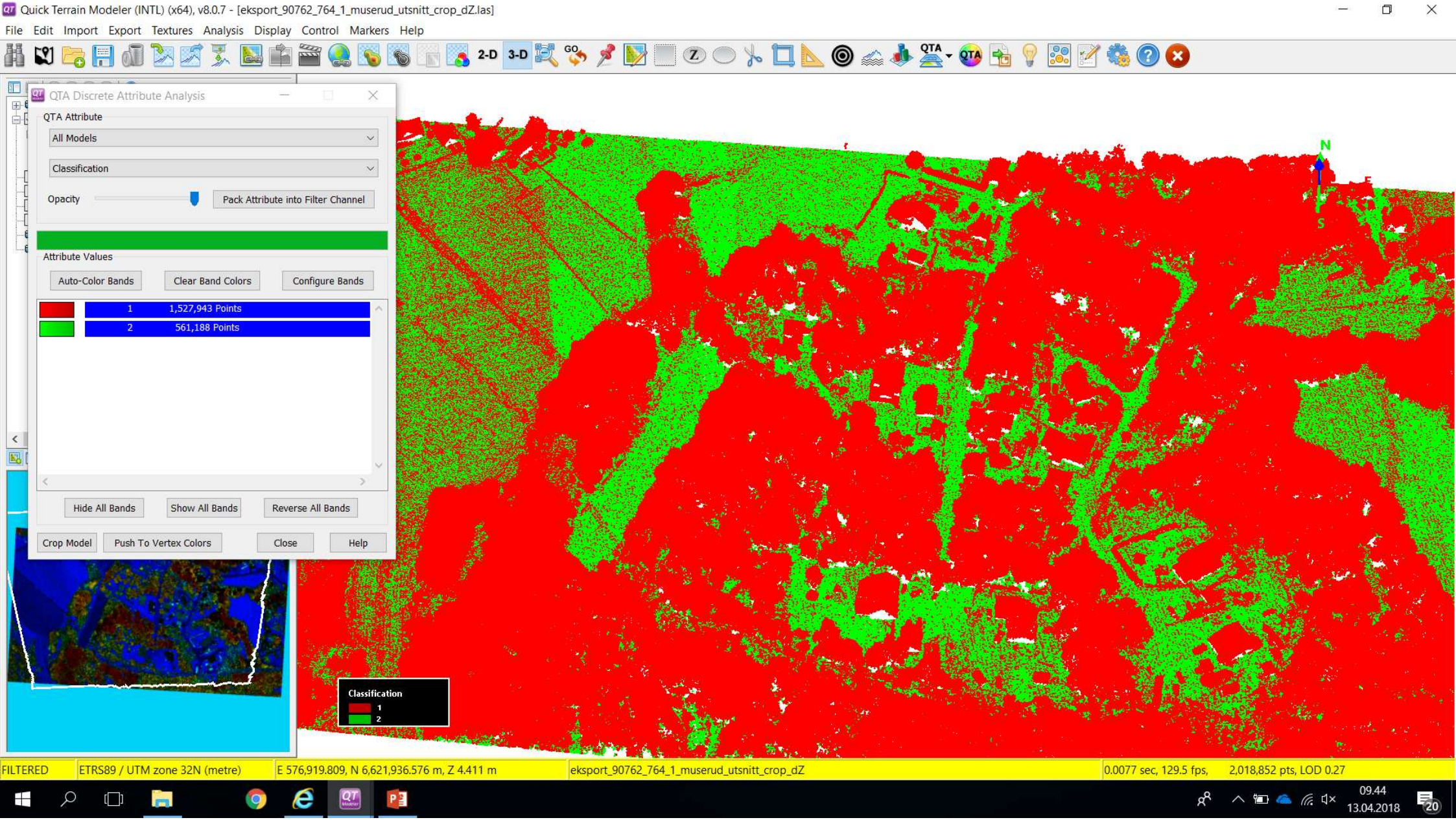

Quick Terrain Modeler (INTL) (x64), v8.0.7 - [eksport_90762_764_1_muserud_utsnitt_crop_dZ.las]
File Edit Import Export Textures Analysis Display Control Markers Help
2-D 3-D
QTA Discrete Attribute Analysis
QTA Attribute
All Models
Z
Opacity
Pack Attribute into Filter Channel
Attribute Values
Auto-Color Bands
Clear Band Colors
Configure Bands
-0.810 m to 2.145 m 1,000,719 Points
2.145 m to 5.100 m 230,445 Points
5.100 m to 8.055 m 237,559 Points
8.055 m to 11.010 m 207,528 Points
11.010 m to 13.965 m 164,166 Points
13.965 m to 16.920 m 120,057 Points
16.920 m to 19.875 m 75,993 Points
19.875 m to 22.830 m 40,226 Points
22.830 m to 25.785 m 11,804 Points
Hide All Bands
Show All Bands
Reverse All Bands
Crop Model
Push To Vertex Colors
Close
Help
N
E
S
Z
0
2
5
8
11
13
16
19
22
25
FILTERED
ETRS89 / UTM zone 32N (metre)
N\A
N\A
0.0096 sec, 103.8 fps, 2,089,131 pts, LOD 0.27
09.39
13.04.2018

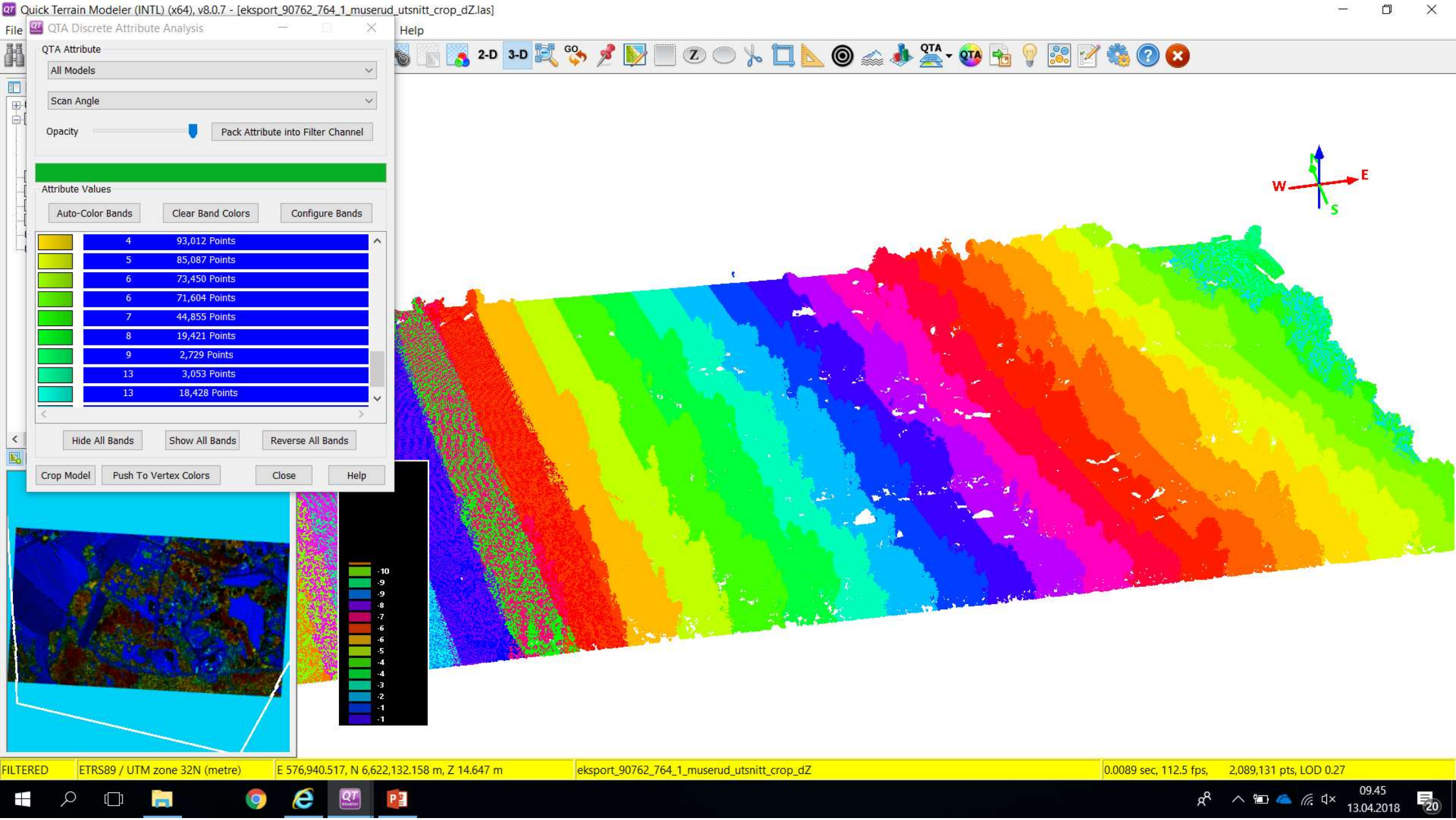

Quick Terrain Modeler (INTL) (x64), v8.0.7 - [eksport_90762_764_1_muserud_utsnitt_crop_dZ.las]
File Edit Import Export Textures Analysis Display Control Markers Help
2-D 3-D
QTA Discrete Attribute Analysis
QTA Attribute
All Models
Return Number
Opacity
Pack Attribute into Filter Channel
Attribute Values
Auto-Color Bands
Clear Band Colors
Configure Bands
1 1,156,057 Points
2 450,257 Points
3 275,938 Points
4 137,406 Points
5 51,699 Points
6 14,341 Points
7 3,433 Points
Hide All Bands
Show All Bands
Reverse All Bands
Crop Model
Push To Vertex Colors
Close
Help
N
S
Return Number
1
2
3
4
5
6
7
FILTERED
ETRS89 / UTM zone 32N (metre)
E 576,877.719, N 6,622,016.082 m, Z 7.435 m
eksport_90762_764_1_muserud_utsnitt_crop_dZ
0.0100 sec, 99.9 fps, 2,089,131 pts, LOD 0.27
09.41
13.04.2018

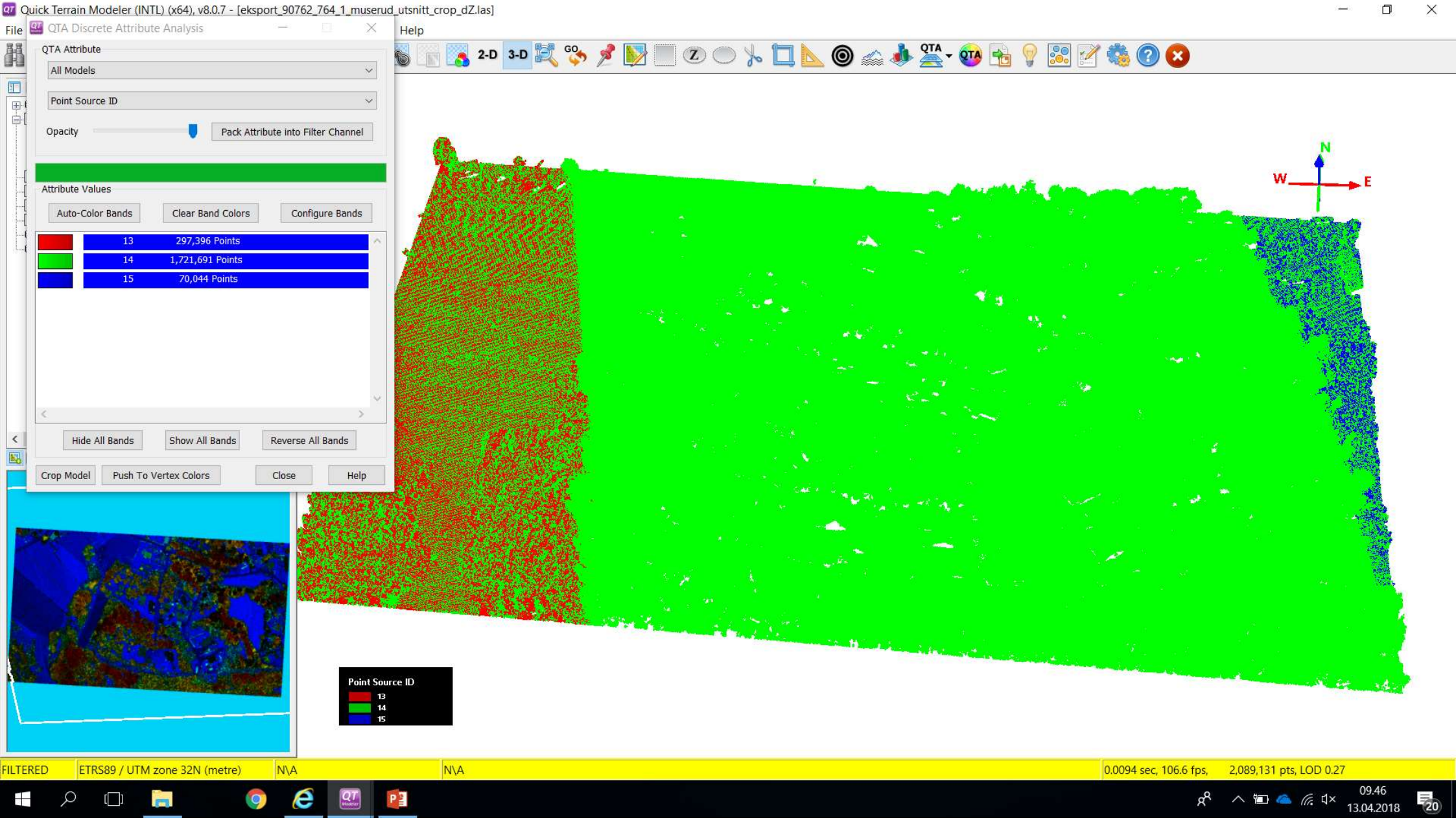

Quick Terrain Modeler (INTL) (x64), v8.0.7 - [eksport_90762_764_1_muserud_utsnitt_crop_dZ.las]
File Edit Import Export Textures Analysis Display Control Markers Help
2-D 3-D
QTA Discrete Attribute Analysis
QTA Attribute
All Models
Return Number
Opacity
Pack Attribute into Filter Channel
Attribute Values
Auto-Color Bands
Clear Band Colors
Configure Bands
1 1,156,057 Points
2 450,257 Points
3 275,938 Points
4 137,406 Points
5 51,699 Points
6 14,341 Points
7 3,433 Points
Hide All Bands
Show All Bands
Reverse All Bands
Crop Model
Push To Vertex Colors
Close
Help
Return Number
1
2
3
4
5
6
7
FILTERED
ETRS89 / UTM zone 32N (metre)
N\A
N\A
0.0059 sec, 169.9 fps, 1,222,984 pts, LOD 0.27
09.42
13.04.2018

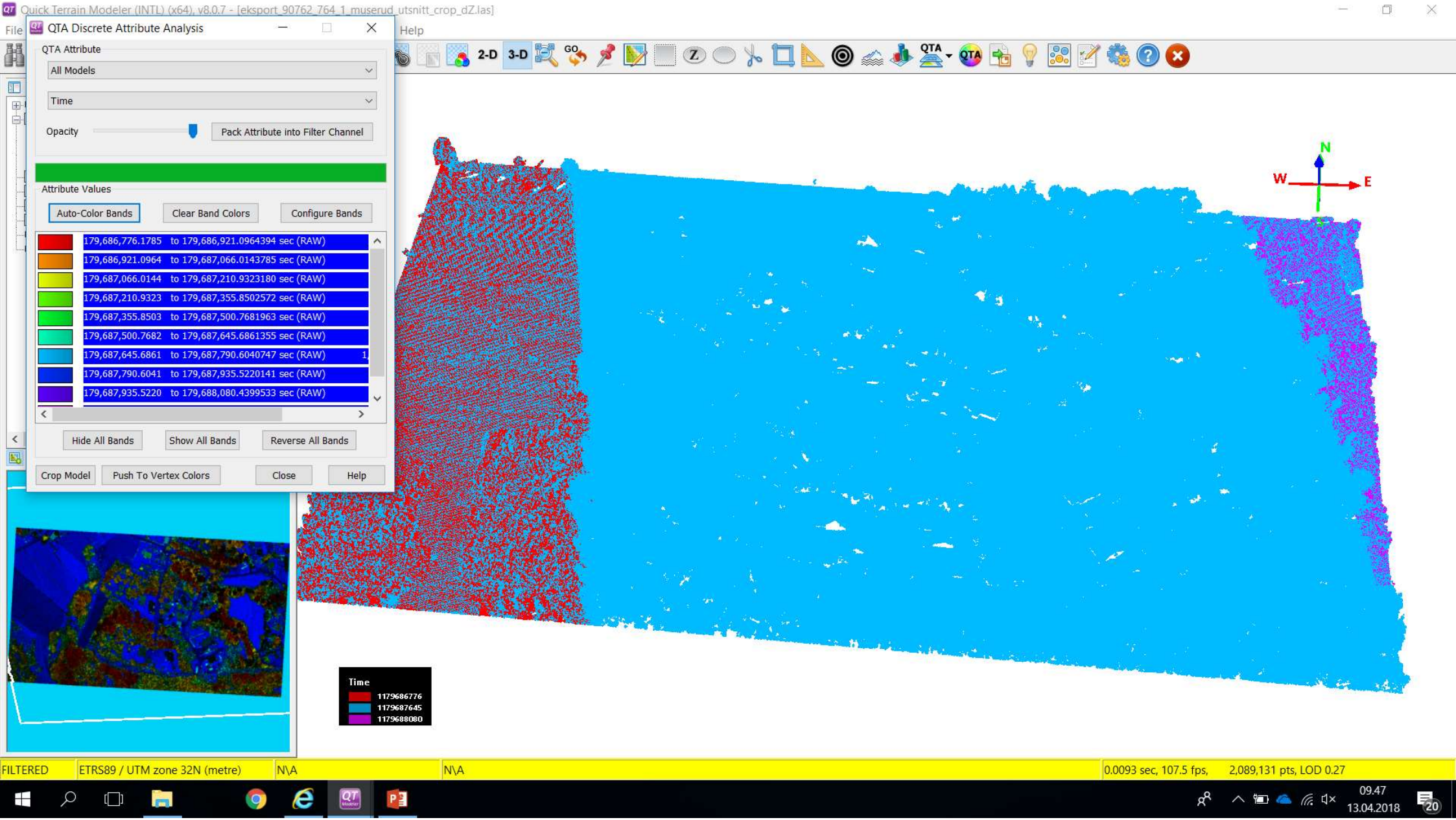

Quick Terrain Modeler (INTL) (x64), v8.0.7 - [eksport_90762_764_1_muserud_utsnitt_crop_dZ.las]
File Edit Import Export Textures Analysis Display Control Markers Help
2-D 3-D
QTA Discrete Attribute Analysis
QTA Attribute
All Models
Number Returns
Opacity
Pack Attribute into Filter Channel
Attribute Values
Auto-Color Bands
Clear Band Colors
Configure Bands
1 704,143 Points
2 347,059 Points
3 415,323 Points
4 344,373 Points
5 187,891 Points
6 69,026 Points
7 21,316 Points
Hide All Bands
Show All Bands
Reverse All Bands
Crop Model
Push To Vertex Colors
Close
Help
N
W
E
Number Returns
1
2
3
4
5
6
7
FILTERED
ETRS89 / UTM zone 32N (metre)
E 576,966.381, N 6,622,037.949 m, Z 19.552 m
eksport_90762_764_1_muserud_utsnitt_crop_dZ
0.0073 sec, 136.2 fps, 1,552,248 pts, LOD 0.27
09.42
13.04.2018

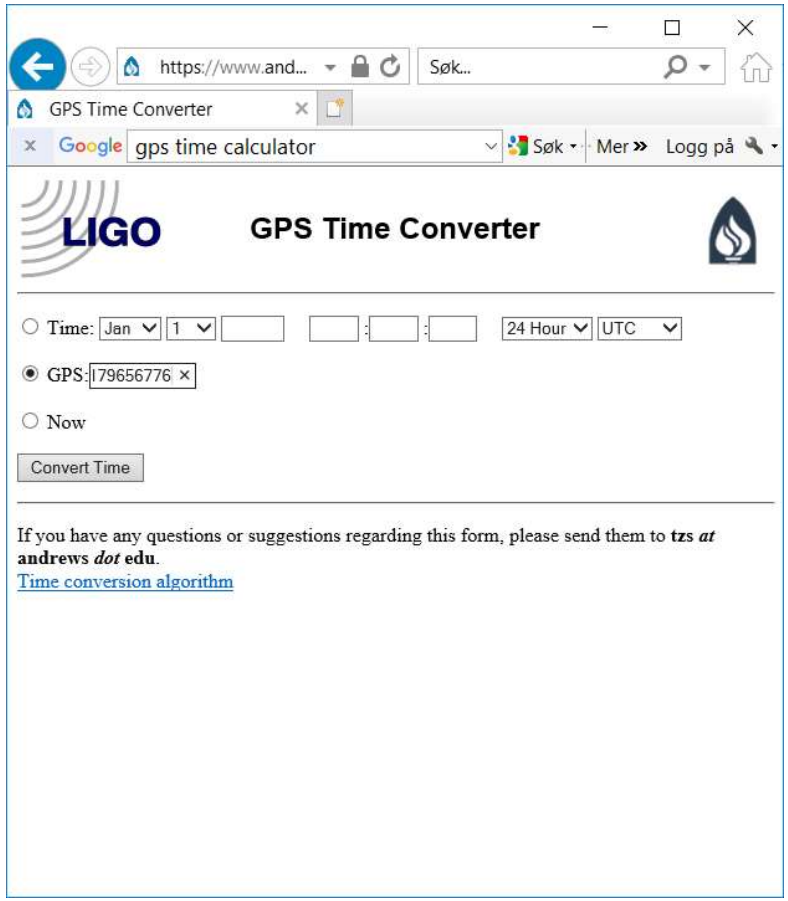

Quick Terrain Modeler (INTL) (x64), v8.0.7 - [eksport_90762_764_1_muserud_utsnitt_crop_dZ.las]
File Edit Import Export Textures Analysis Display Control Markers Help
Cloud Point Appearance
Antialiased (circular) points?
Size
Fixed Size
Point Autosize
Voxel Autosize
Close
Help
Attribute Values
Auto-Color Bands
Clear Band Colors
Configure Bands
1 704,143 Points
2 347,059 Points
3 415,323 Points
4 344,373 Points
5 187,891 Points
6 69,026 Points
7 21,316 Points
Hide All Bands
Show All Bands
Reverse All Bands
Crop Model
Push To Vertex Colors
Close
Help
Number Returns
1
2
3
4
5
6
7
N
W
E
FILTERED
ETRS89 / UTM zone 32N (metre)
N\A
N\A
0.0097 sec, 102.8 fps, 1,845,379 pts, LOD 0.27
09.43
13.04.2018

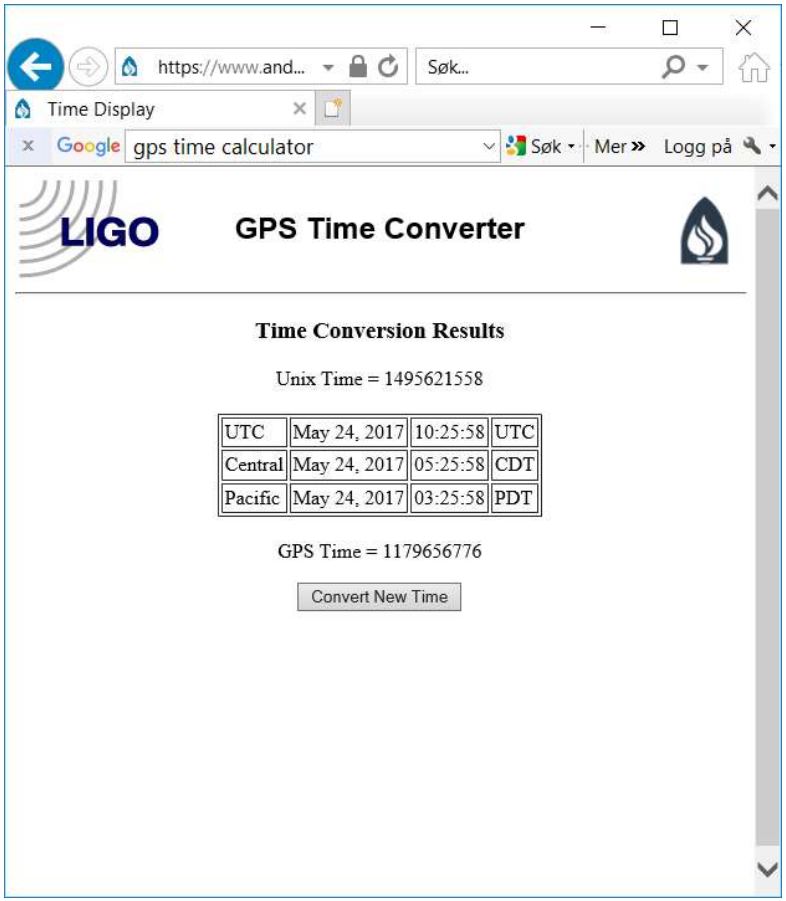

Quick Terrain Modeler (INTL) (x64), v8.0.7 - [eksport_90762_764_1_muserud_utsnitt_crop_dZ.las]
File Edit Import Export Textures Analysis Display Control Markers Help
2-D 3-D
QTA Discrete Attribute Analysis
QTA Attribute
All Models
Classification
Opacity
Pack Attribute into Filter Channel
Attribute Values
Auto-Color Bands
Clear Band Colors
Configure Bands
1 1,527,943 Points
2 561,188 Points
Hide All Bands
Show All Bands
Reverse All Bands
Crop Model
Push To Vertex Colors
Close
Help
N
E
S
Classification
1
2
FILTERED
ETRS89 / UTM zone 32N (metre)
E 576,919.809, N 6,621,936.576 m, Z 4.411 m
eksport_90762_764_1_muserud_utsnitt_crop_dZ
0.0077 sec, 129.5 fps, 2,018,852 pts, LOD 0.27
09.44
13.04.2018

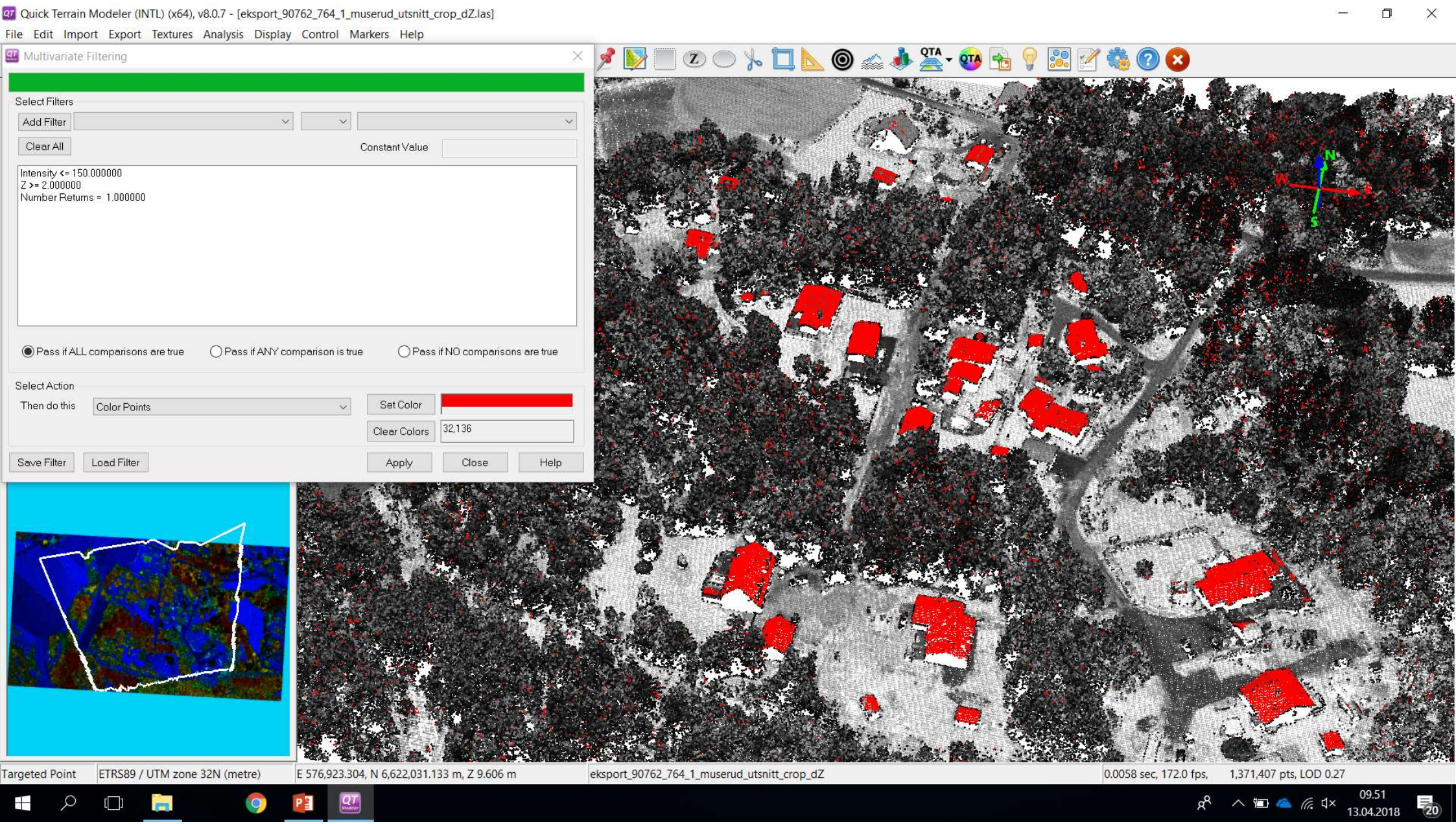

Quick Terrain Modeler (INTL) (x64), v8.0.7 - [eksport_90762_764_1_muserud_utsnitt_crop_dZ.las]
File
Help
QTA Discrete Attribute Analysis
QTA Attribute
All Models
Scan Angle
Opacity
Pack Attribute into Filter Channel
Attribute Values
Auto-Color Bands
Clear Band Colors
Configure Bands
4 93,012 Points
5 85,087 Points
6 73,450 Points
6 71,604 Points
7 44,855 Points
8 19,421 Points
9 2,729 Points
13 3,053 Points
13 18,428 Points
Hide All Bands
Show All Bands
Reverse All Bands
Crop Model
Push To Vertex Colors
Close
Help
2-D
3-D
QTA
N
E
W
S
FILTERED
ETRS89 / UTM zone 32N (metre)
E 576,940.517, N 6,622,132.158 m, Z 14.647 m
eksport_90762_764_1_muserud_utsnitt_crop_dZ
0.0089 sec, 112.5 fps,
2,089,131 pts, LOD 0.27
09.45
13.04.2018


Quick Terrain Modeler (INTL) (x64), v8.0.7 - [eksport_90762_764_1_muserud_utsnitt_crop_dZ.las]
File
Help
QTA Discrete Attribute Analysis
QTA Attribute
All Models
Point Source ID
Opacity
Pack Attribute into Filter Channel
Attribute Values
Auto-Color Bands
Clear Band Colors
Configure Bands
13 297,396 Points
14 1,721,691 Points
15 70,044 Points
Hide All Bands
Show All Bands
Reverse All Bands
Crop Model
Push To Vertex Colors
Close
Help
2-D
3-D
QTA
N
W
E
Point Source ID
13
14
15
FILTERED
ETRS89 / UTM zone 32N (metre)
N\A
N\A
0.0094 sec, 106.6 fps, 2,089,131 pts, LOD 0.27
09.46
13.04.2018

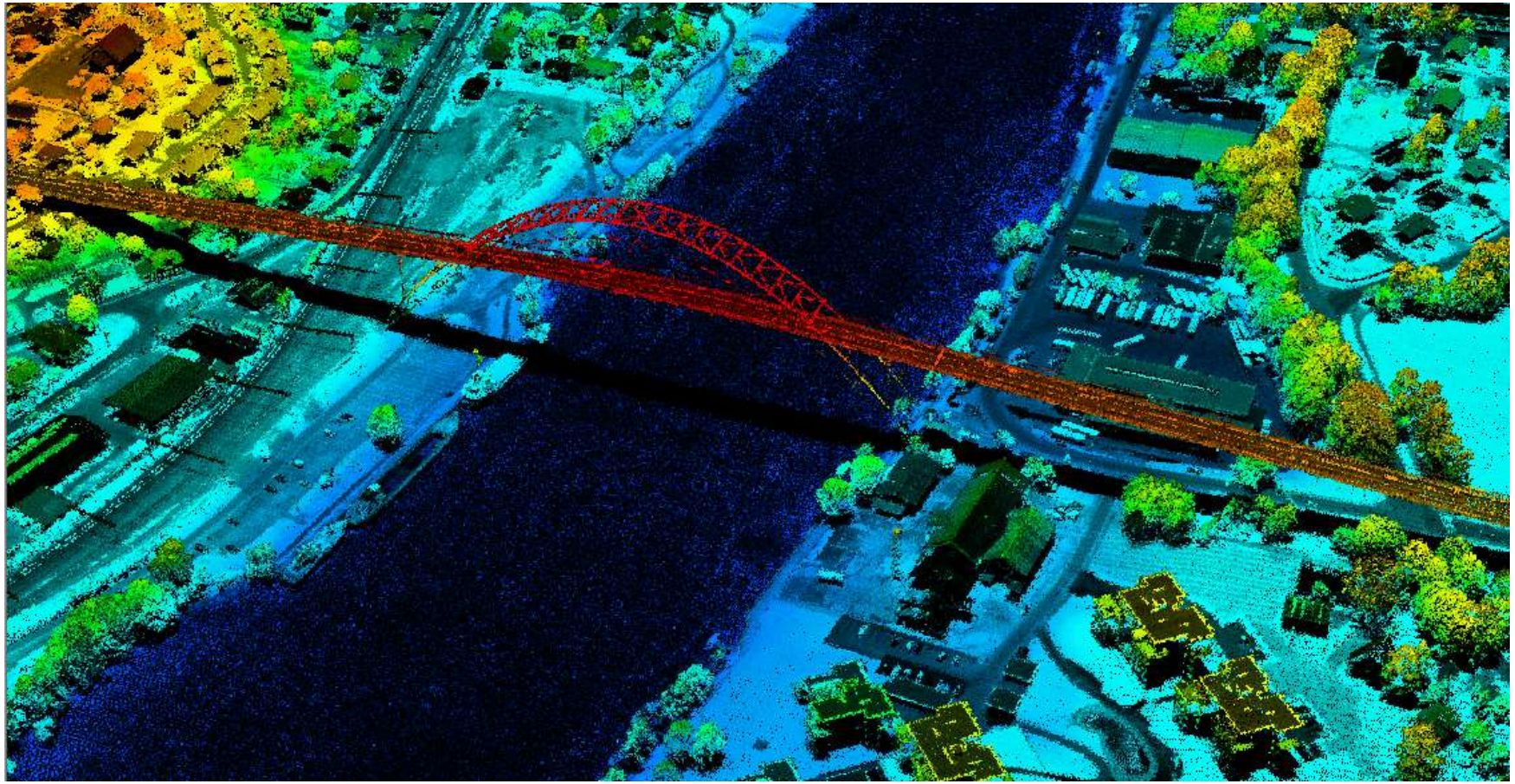

Quick Terrain Modeler (INTL) (x64), v8.0.7 - [eksport_90762_764_1_muserud_utsnitt_crop_dZ.las]
File
Help
QTA Discrete Attribute Analysis
QTA Attribute
All Models
Time
Opacity
Pack Attribute into Filter Channel
Attribute Values
Auto-Color Bands
Clear Band Colors
Configure Bands
179,686,776.1785 to 179,686,921.0964394 sec (RAW)
179,686,921.0964 to 179,687,066.0143785 sec (RAW)
179,687,066.0144 to 179,687,210.9323180 sec (RAW)
179,687,210.9323 to 179,687,355.8502572 sec (RAW)
179,687,355.8503 to 179,687,500.7681963 sec (RAW)
179,687,500.7682 to 179,687,645.6861355 sec (RAW)
179,687,645.6861 to 179,687,790.6040747 sec (RAW)
179,687,790.6041 to 179,687,935.5220141 sec (RAW)
179,687,935.5220 to 179,688,080.4399533 sec (RAW)
Hide All Bands
Show All Bands
Reverse All Bands
Crop Model
Push To Vertex Colors
Close
Help
N
W
E
Time
1179686776
1179687645
1179688080
FILTERED
ETRS89 / UTM zone 32N (metre)
N\A
N\A
0.0093 sec, 107.5 fps, 2,089,131 pts, LOD 0.27
09.47
13.04.2018


https://www.and...
Søk...
GPS Time Converter
Google
gps time calculator
Søk
Mer
Logg på
LIGO
GPS Time Converter
Time: Jan 1 24 Hour UTC
GPS: 1179656776
Now
Convert Time
If you have any questions or suggestions regarding this form, please send them to tzs at andrews dot edu.
Time conversion algorithm


https://www.and...
Søk...
Time Display
Google
gps time calculator
Søk
Mer
Logg på
LIGO
GPS Time Converter
Time Conversion Results
Unix Time = 1495621558
UTC May 24, 2017 10:25:58 UTC
Central May 24, 2017 05:25:58 CDT
Pacific May 24, 2017 03:25:58 PDT
GPS Time = 1179656776
Convert New Time


Quick Terrain Modeler (INTL) (x64), v8.0.7 - [eksport_90762_764_1_muserud_utsnitt_crop_dZ.las]
File Edit Import Export Textures Analysis Display Control Markers Help
Multivariate Filtering
Select Filters
Add Filter
Clear All
Constant Value
Intensity <= 150.000000
Z >= 2.000000
Number Returns = 1.000000
Pass if ALL comparisons are true
Pass if ANY comparison is true
Pass if NO comparisons are true
Select Action
Then do this
Color Points
Set Color
Clear Colors
32,136
Save Filter
Load Filter
Apply
Close
Help
N
W
E
S
Targeted Point
ETRS89 / UTM zone 32N (metre)
E 576,923.304, N 6,622,031.133 m, Z 9.606 m
eksport_90762_764_1_muserud_utsnitt_crop_dZ
0.0058 sec, 172.0 fps,
1,371,407 pts, LOD 0.27
09.51
13.04.2018

Vi har en skatt tilgjengelig helt gratis – bruk den!



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