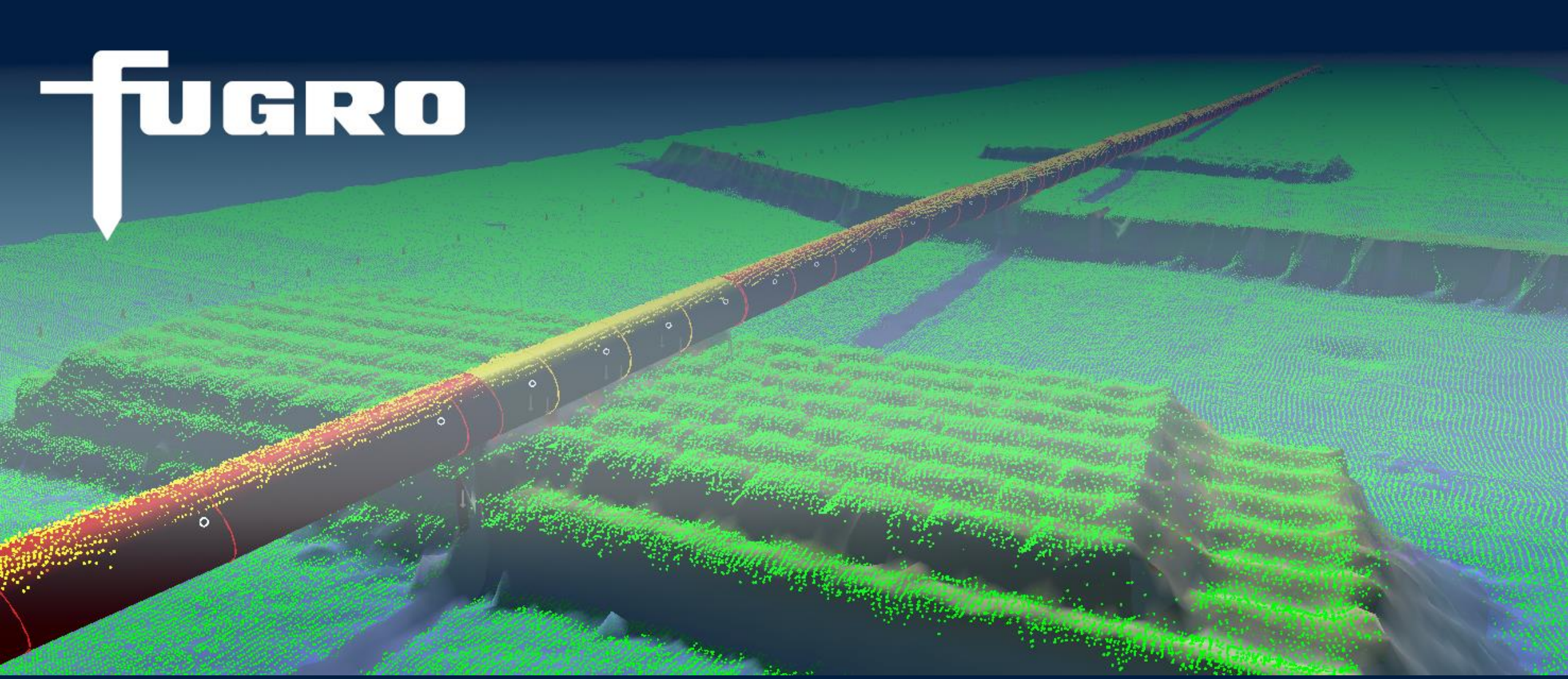


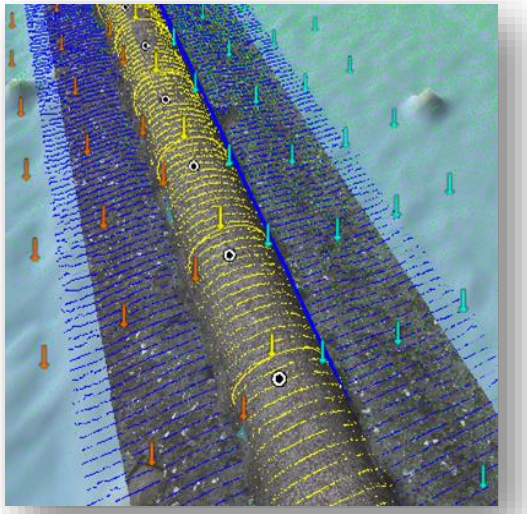
A cloud-based solution to AUV Pipeline Inspection

AUT 2019
Lex Veerhuis

Why is this relevant?

- AUV acquisition **speeds are four times faster** than traditional methods
- Laser point cloud **data is seven times denser** than MBES sensors
- Acquiring more data, quicker, makes **vessel-based processing unmanageable**
- Increased data resolution means average project now requires **several terabytes of storage**

Performing an AUV Pipeline Inspection…

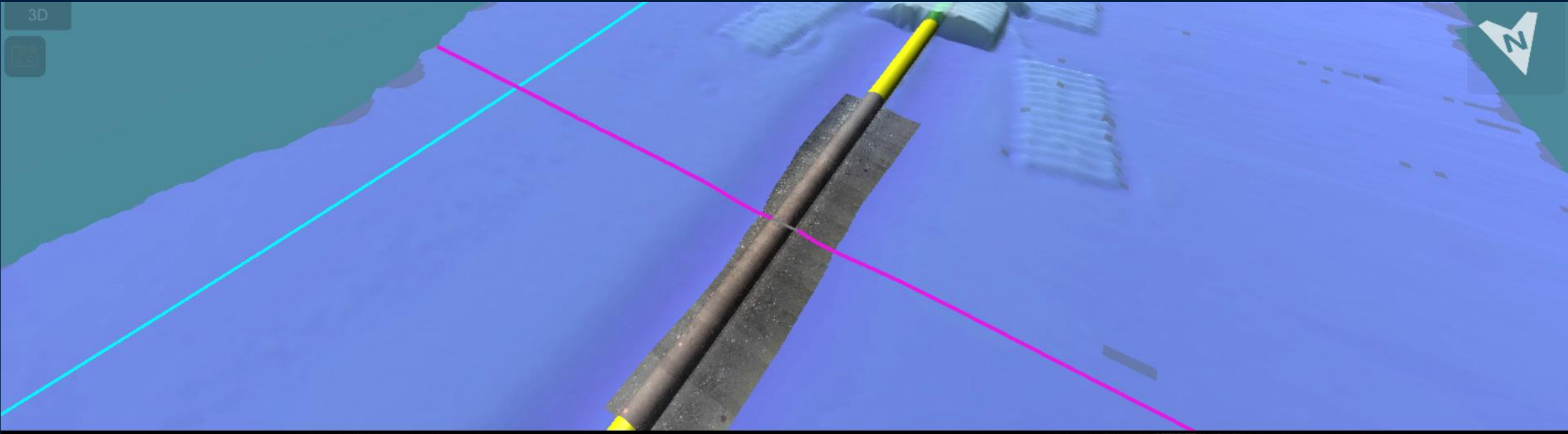


State-of-the-art AUV and survey grade sensors

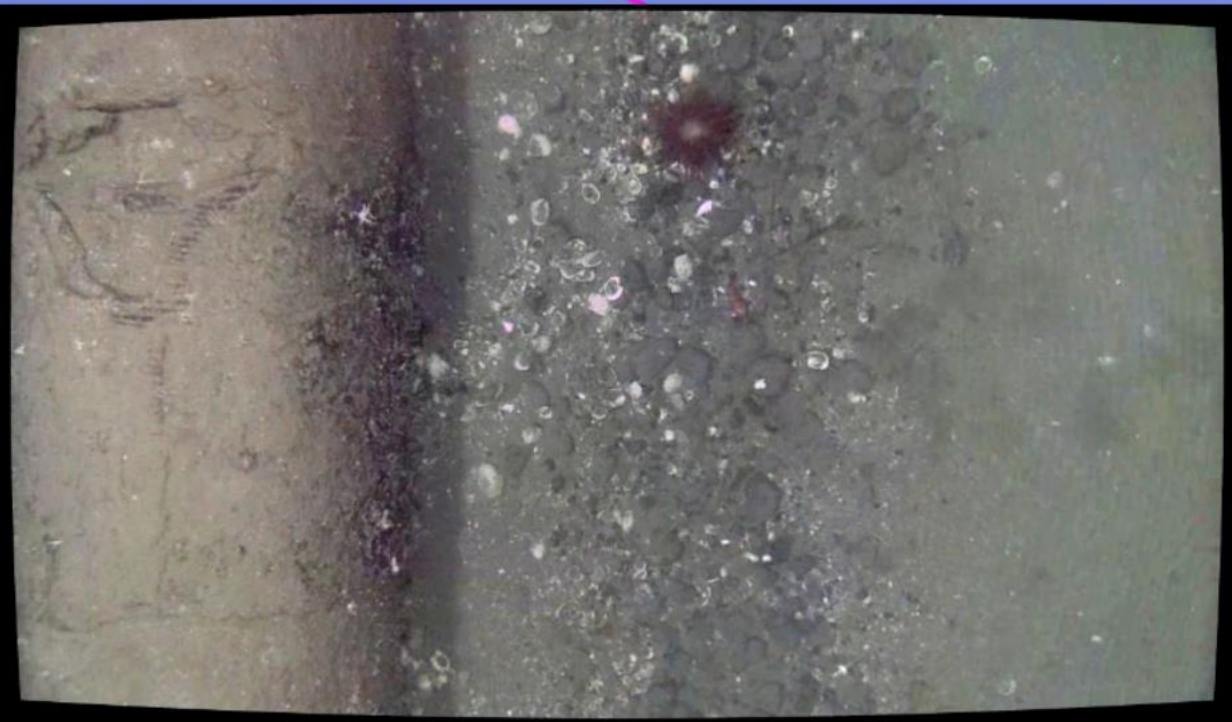
Optimised and robust VSAT connections

Bespoke automated machine learning algorithms

Web based delivery to Client while the Vessel is infield.


3D

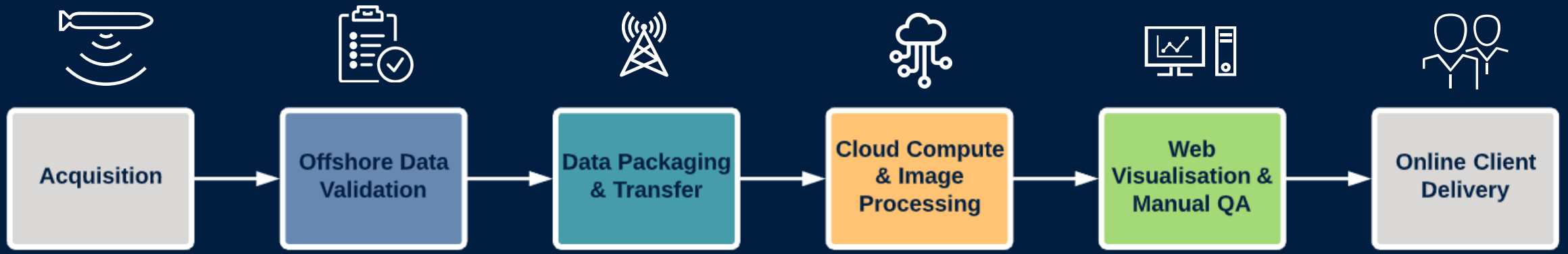

26/08/19
02:04:08
E 430,678.4
KP 0.552
N 6,742,074.2
DCC 4.70
D 125.93m
H -45.5



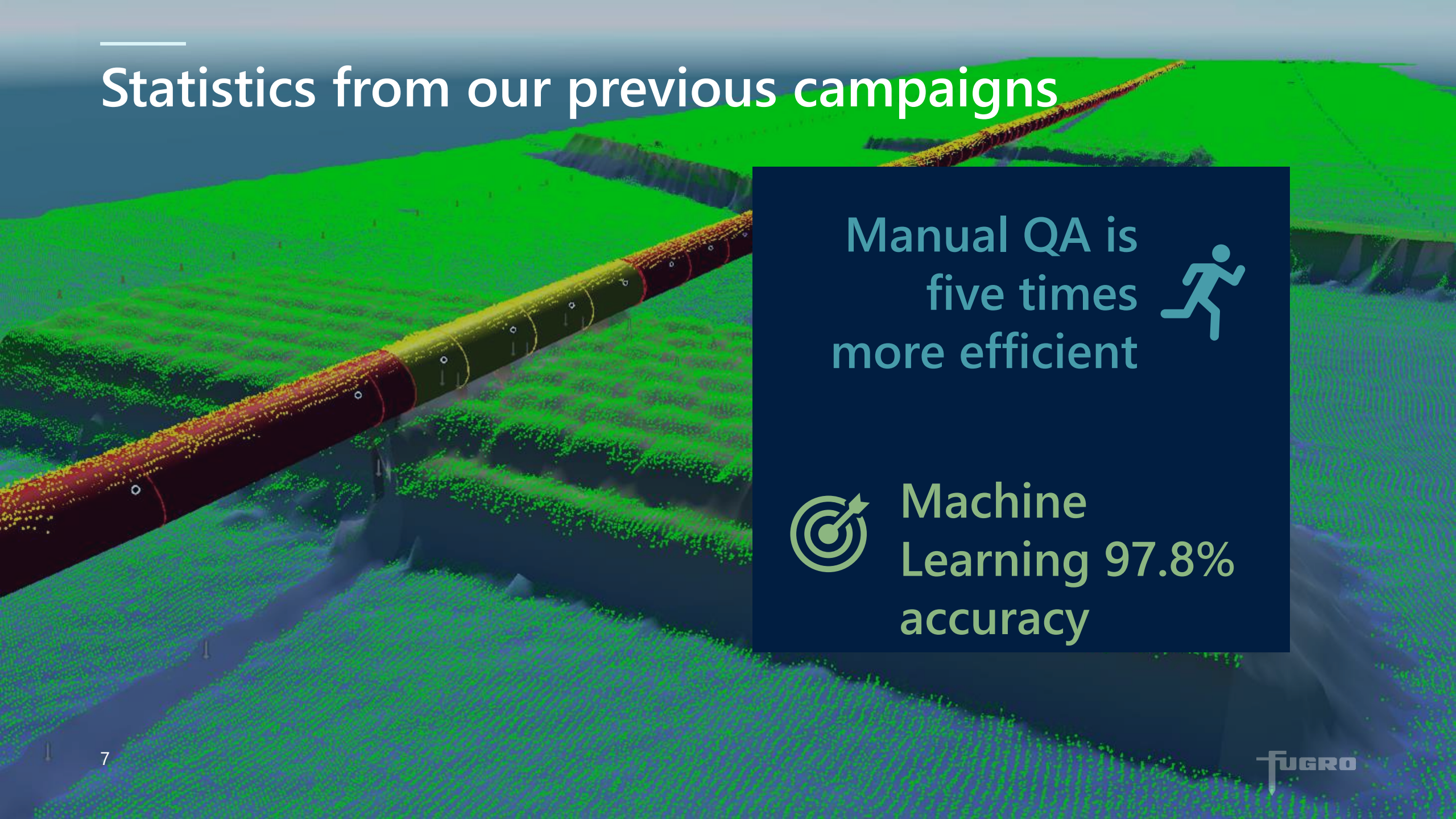
It makes lives easier!

- **Faster Delivery**
- **Zero IT Footprint**
- **Centralised Storage & Security**
- **Scalable, on-demand compute resources**
- **Distributed, Flexible Teams**
- **Process Auditability**

A high-level overview



Statistics from our previous campaigns



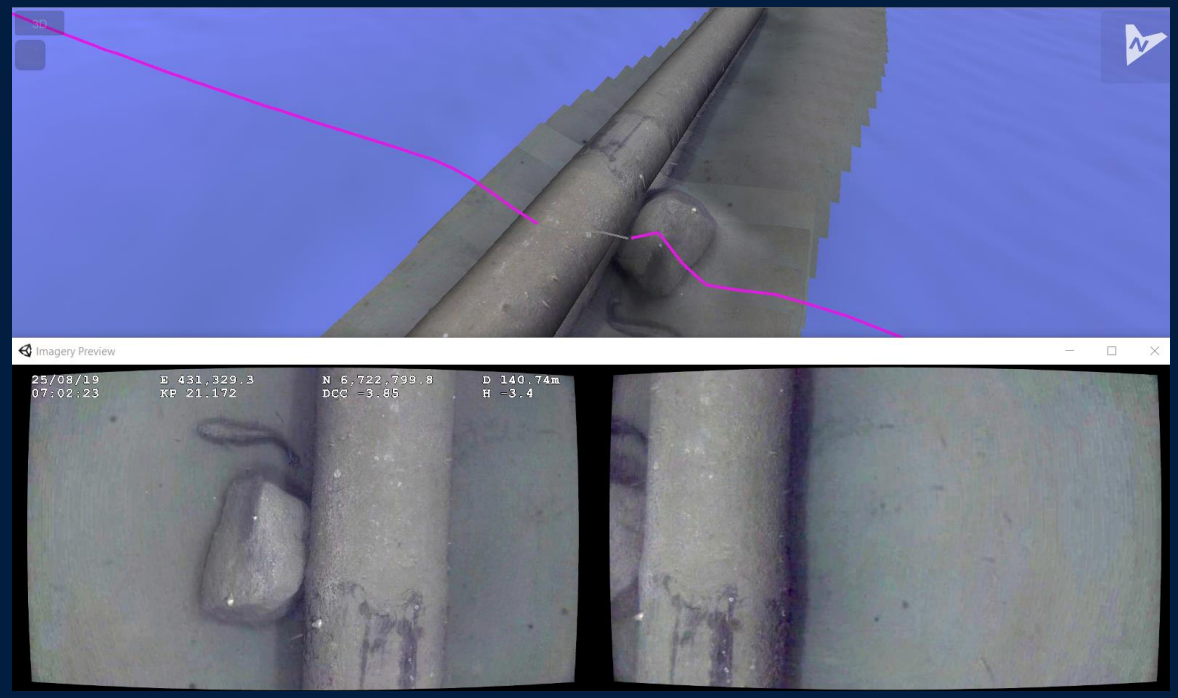
Manual QA is five times more efficient

Machine Learning 97.8% accuracy

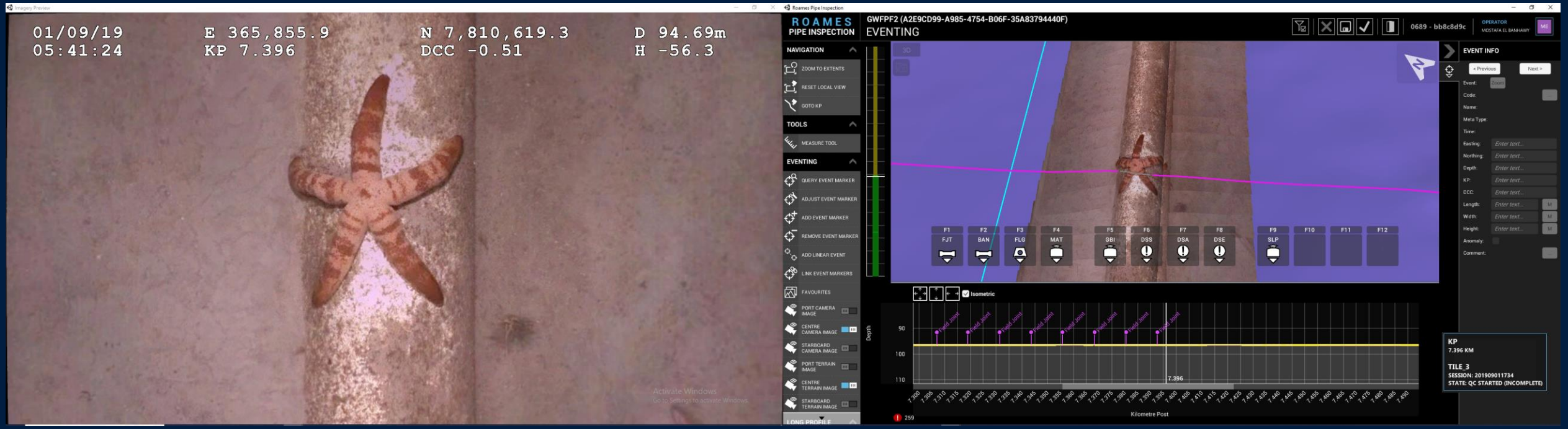
Near Real-Time Image Processing

- Superior alignment between images over (3rd party) industry standard applications

- Image correction and orthorectification almost completely automated from the point of acquisition through to the 3D modeling stage



Offline Eventing



Offline Eventing

- Imagery fully orthorectified and projected onto 3D visualization to provide spatial context

- Dynamic Overlay on Images

- Fully audit trail within the eventing system:
  - Which images have been viewed and how many times?
  - Who's working on what right now?
  - What's outstanding?
  - Who evented what feature?

Client Delivery formats

Near real-time delivery:

- 9-Point position listing (.csv export)
- Client specific event listing e.g. SITRAS, COABIS, Nexus (browser-based / .csv export)
- Fugro Client Viewer or EIVA NaviModel project

Final deliverables (in addition to the above):

- Gridded DTM XYZ export (Laser and MBES)
- Soundings XYZ export (Laser and MBES)
- GeoTIFF export (per 100m tile)
- Full resolution imagery with overlay
- GIS compatible export
- Mosaiced imagery (per head)

It makes lives easier!

- **Faster Delivery**
- **Zero IT Footprint**
- **Centralised Storage & Security**
- **Scalable, on-demand compute resources**
- **Distributed, Flexible Teams**
- **Process Auditability**

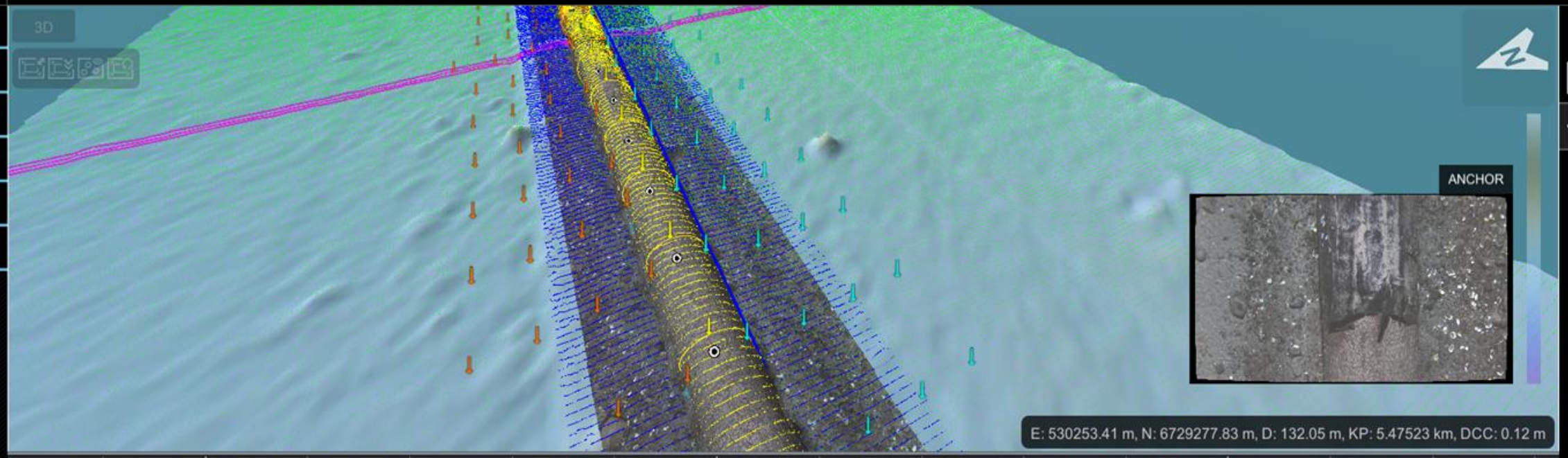
Thank you

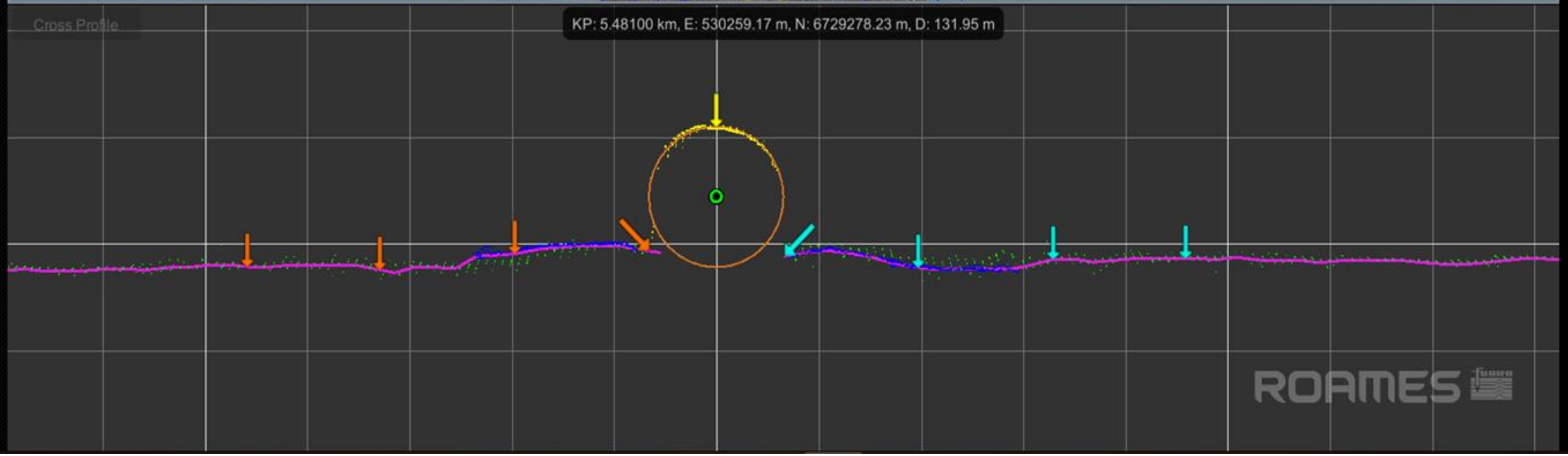
l.veerhuis@fugro.com

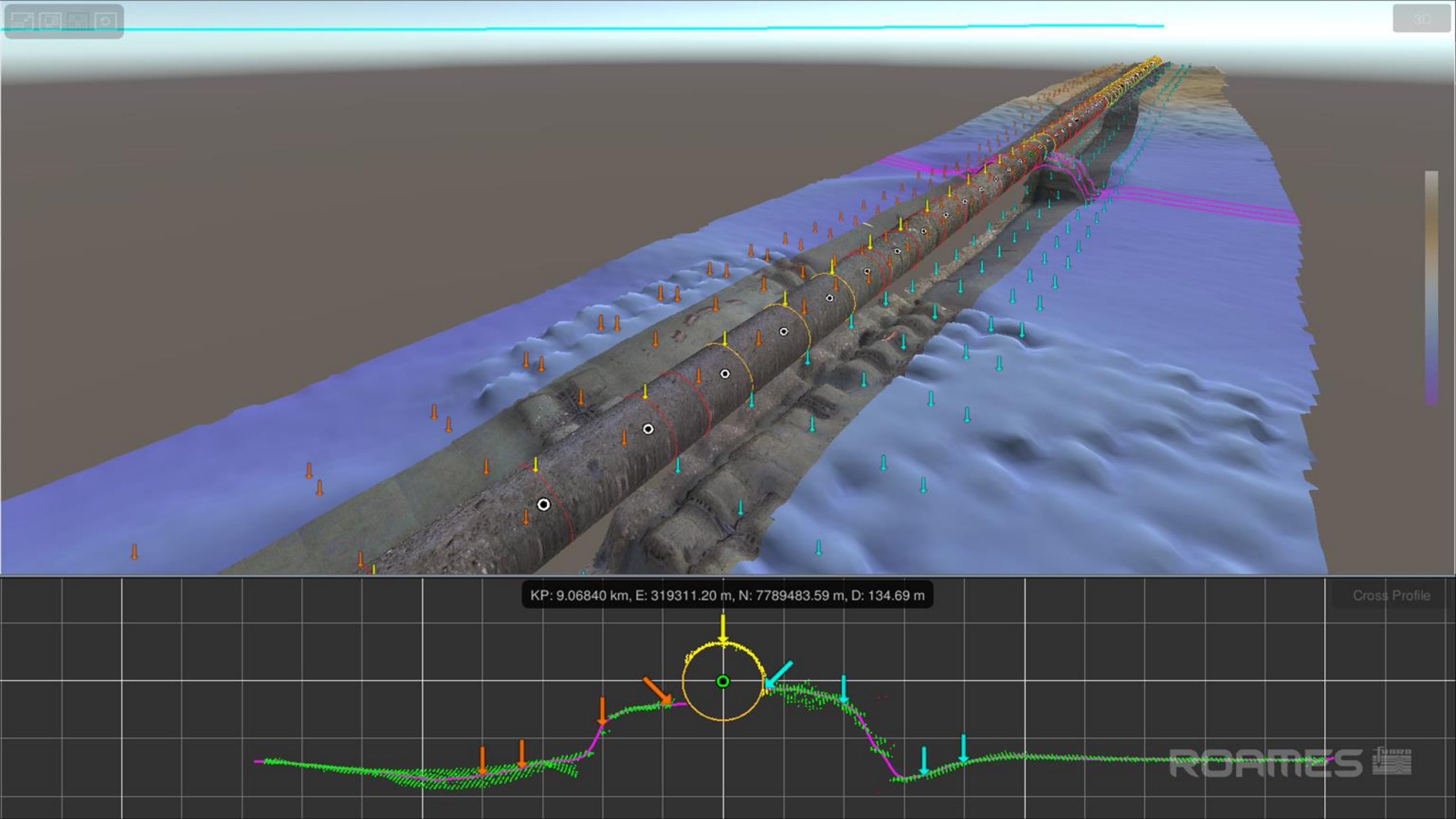
www.fugro.com

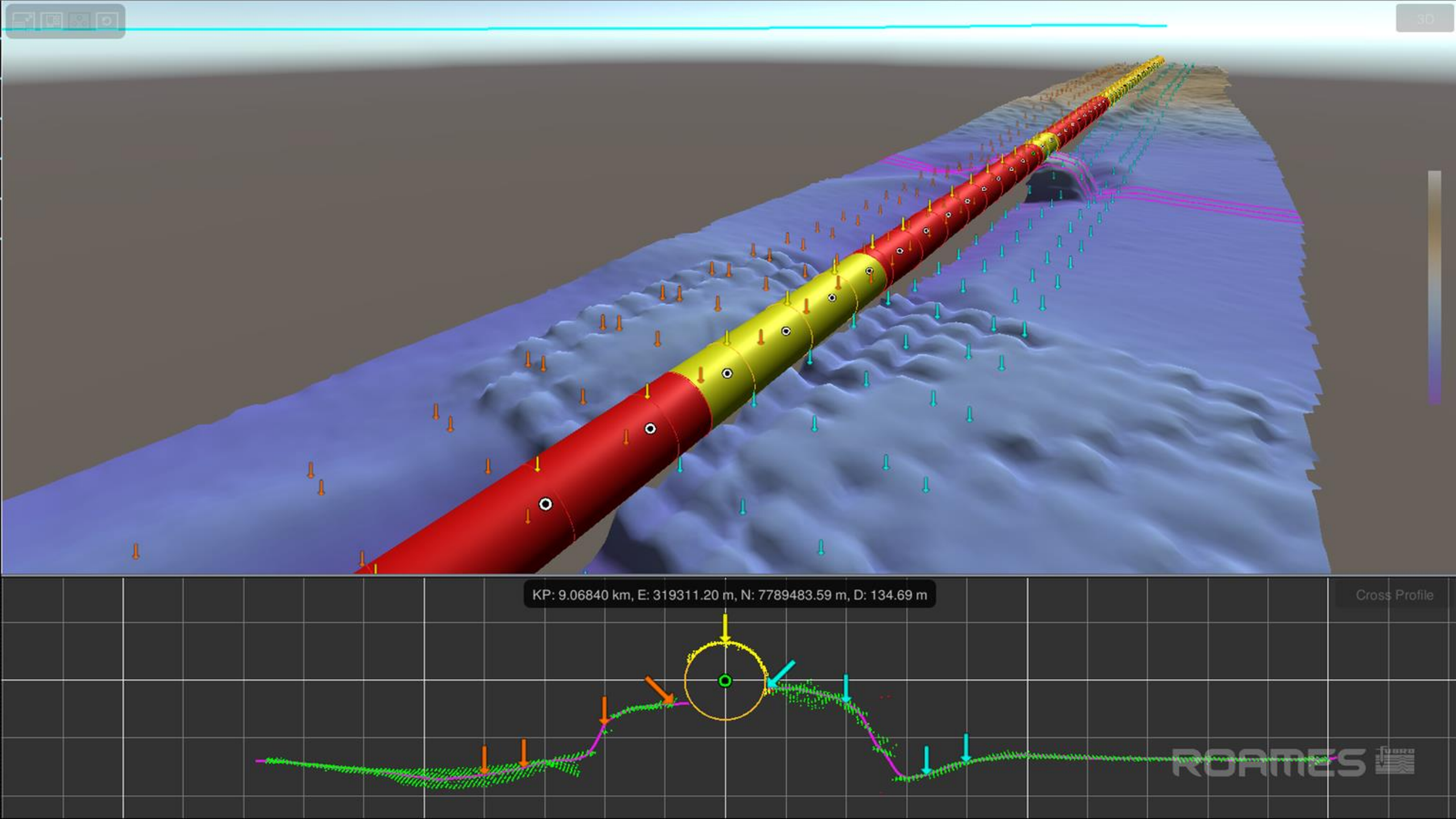
Roames Video Channel

Click here


3D
ANCHOR
E: 530253.41 m, N: 6729277.83 m, D: 132.05 m, KP: 5.47523 km, DCC: 0.12 m


Cross Profile
KP: 5.48100 km, E: 530259.17 m, N: 6729278.23 m, D: 131.95 m
ROAMES


3D
KP: 9.06840 km, E: 319311.20 m, N: 7789483.59 m, D: 134.69 m
Cross Profile
ROAMES


KP: 9.06840 km, E: 319311.20 m, N: 7789483.59 m, D: 134.69 m
Cross Profile
ROAMES


FUGRO
NEXT
REMOTE OPERATIONS SUPPORT
PipeInspection API UAT - Operations
168
24

PipeInspection API UAT - Operati

Sumo Logic Inc. [US] | service.au.sumologic.com/ui/dashboard.html?k=P1D4clkOUXnlWi4Nft3npFI7o3Pc2SXg3RXm7XMnrho12VIl8qcXeavTTCGZ&f=&t=r

PipeInspection API UAT - Operations

LIVE MODE

sumo logic

QC Begin Operations

159

QC Operations Failed

-

Eventing Begin Operations

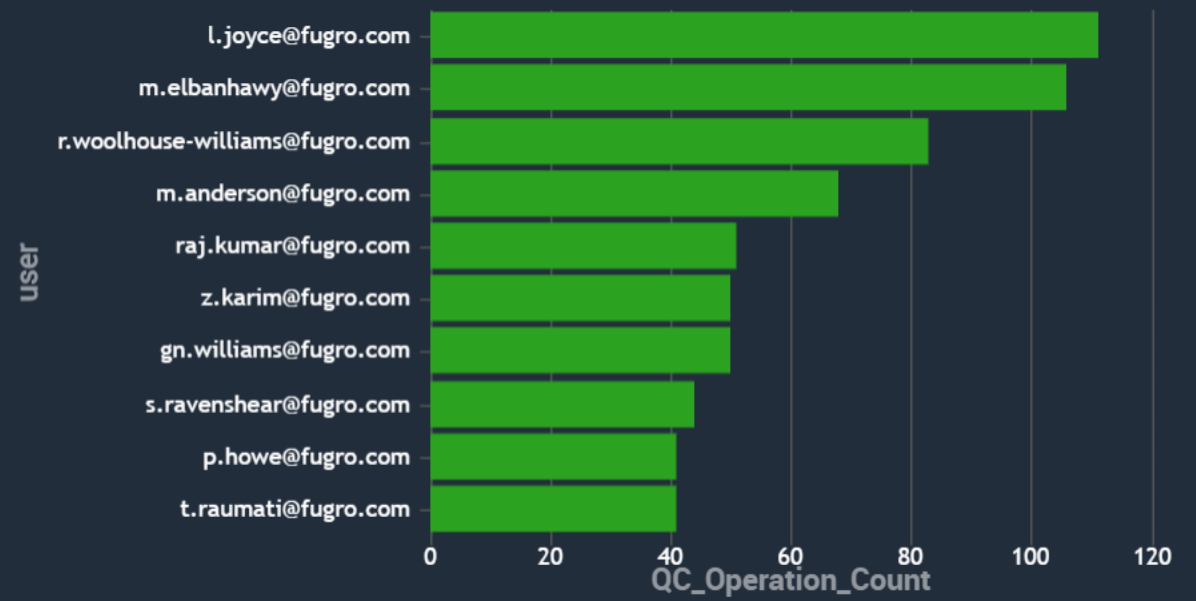
23

Eventing Operations Failed

-

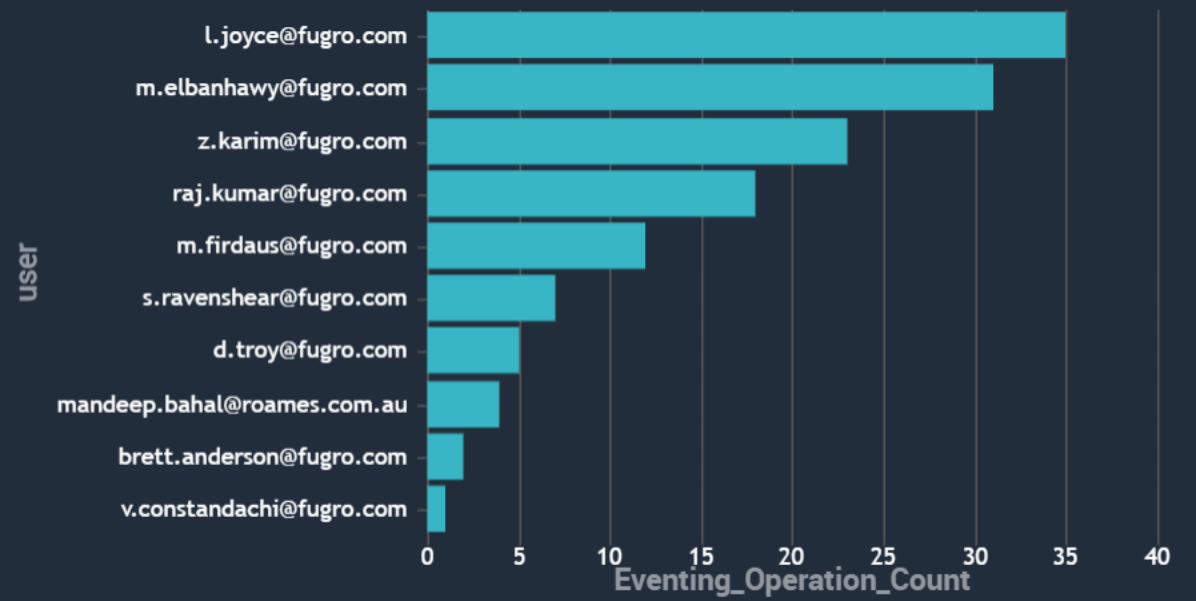
Top QC users

Last 24 Hours



Top Eventing Users

Last 24 Hours

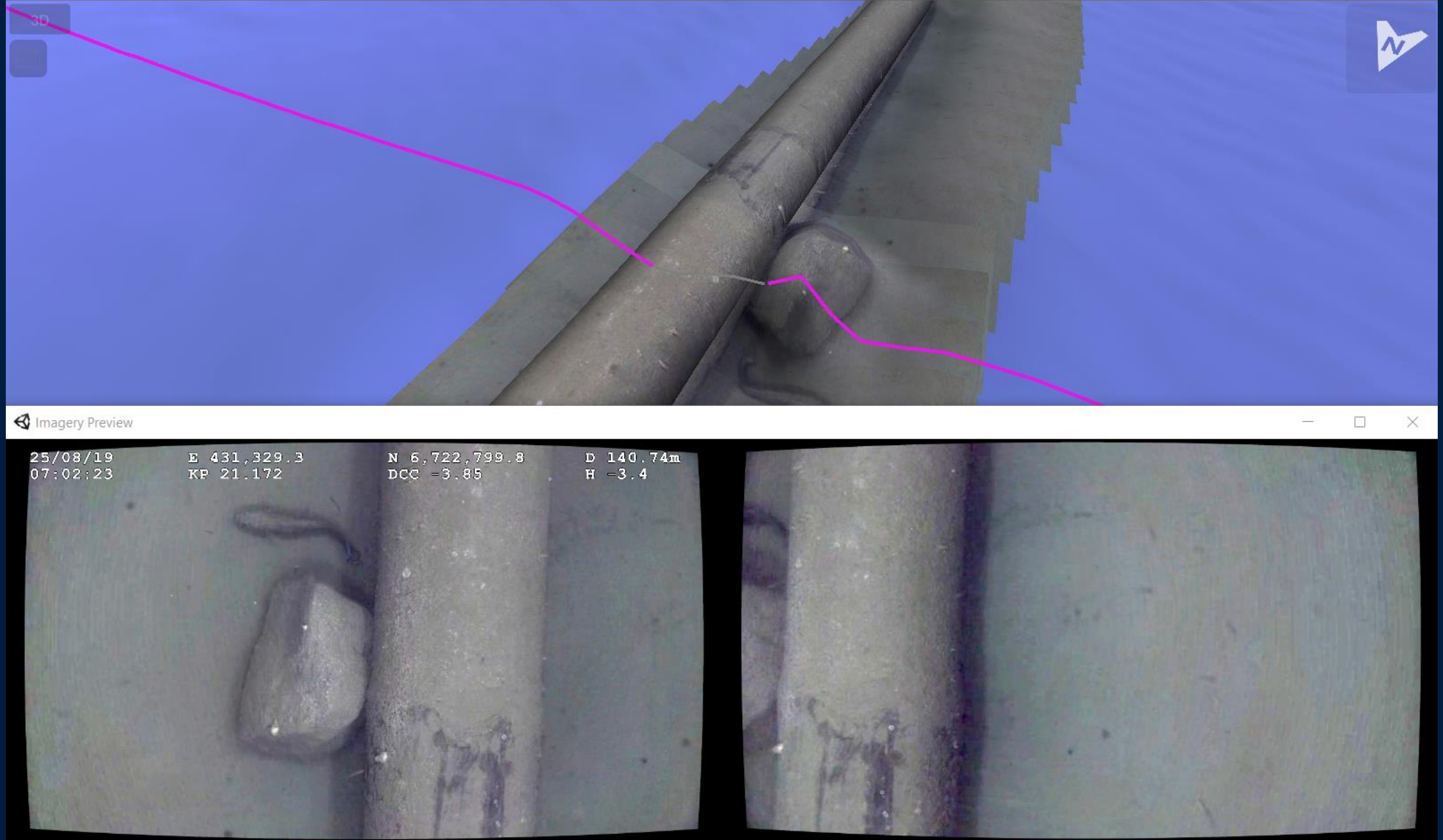


Sessions Created

Last 6 Hours

Tiles Created

Last 6 Hours


3D
Imagery Preview
25/08/19
07:02:23
E 431,329.3
KP 21.172
N 6,722,799.8
DCC -3.85
D 140.74m
H -3.4

Roames Pipe Inspection

ROAMES PIPE INSPECTION

PL2759 (71F56F3E-F784-4D8B-B73A-574ACE113004)

EVENTING

0005 - c530a36e

OPERATOR
STEPHEN BERTRAM
SB

LEGEND
TOP OF PIPE
PIPE
BOTTOM OF PIPE
MEAN ADJACENT
MEAN ADJACENT MESH
MEAN SEABED
EVENTS
HISTORIC EVENTS

VISIBILITY
EVENT MARKERS
LIGHT AZIMUTH
-135
LIGHT ALTITUDE
45
HOTKEYS
IMAGES
IMAGE SHADOW
VERTICAL IMAGE CLIP
HORIZONTAL IMAGE CLIP

3D

DB

F7 F8 F9 F10 F11 F12

Depth
112
114
116
118
120
122
124

Debris
Debris

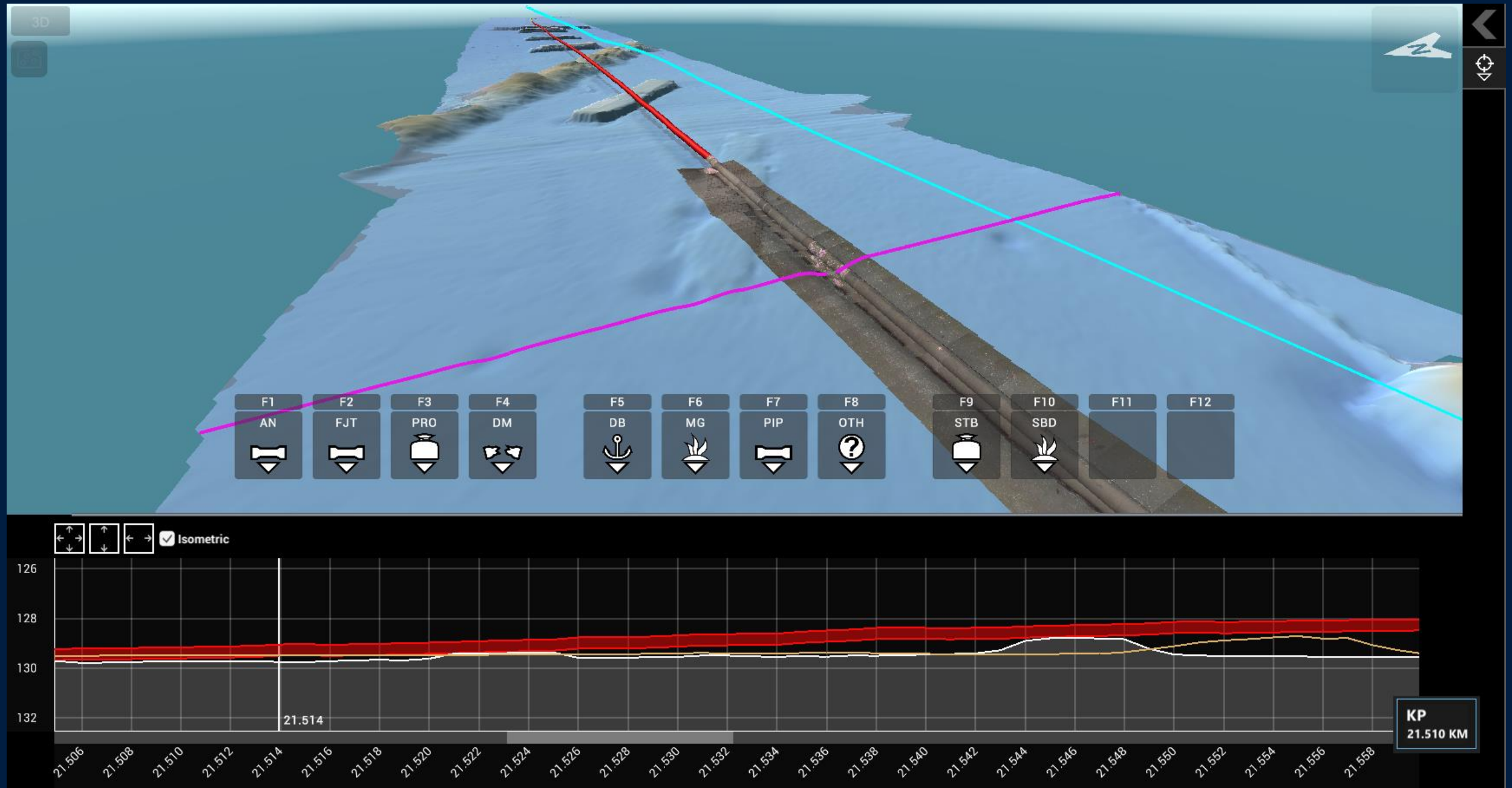
87.966

KP
87.973 KM

87.890 87.892 87.894 87.896 87.898 87.900 87.902 87.904 87.906 87.908 87.910 87.912 87.914 87.916 87.918 87.920 87.922 87.924 87.926 87.928 87.930 87.932 87.934 87.936 87.938 87.940 87.942 87.944 87.946 87.948 87.950 87.952 87.954 87.956 87.958 87.960 87.962 87.964 87.966 87.968 87.970 87.972 87.974 87.976 87.978 87.980 87.982 87.984

Kilometre Post

8


3D
F1
AN
F2
FJT
F3
PRO
F4
DM
F5
DB
F6
MG
F7
PIP
F8
OTH
F9
STB
F10
SBD
F11
F12
Isometric
126
128
130
132
21.514
21.506
21.508
21.510
21.512
21.514
21.516
21.518
21.520
21.522
21.524
21.526
21.528
21.530
21.532
21.534
21.536
21.538
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21.546
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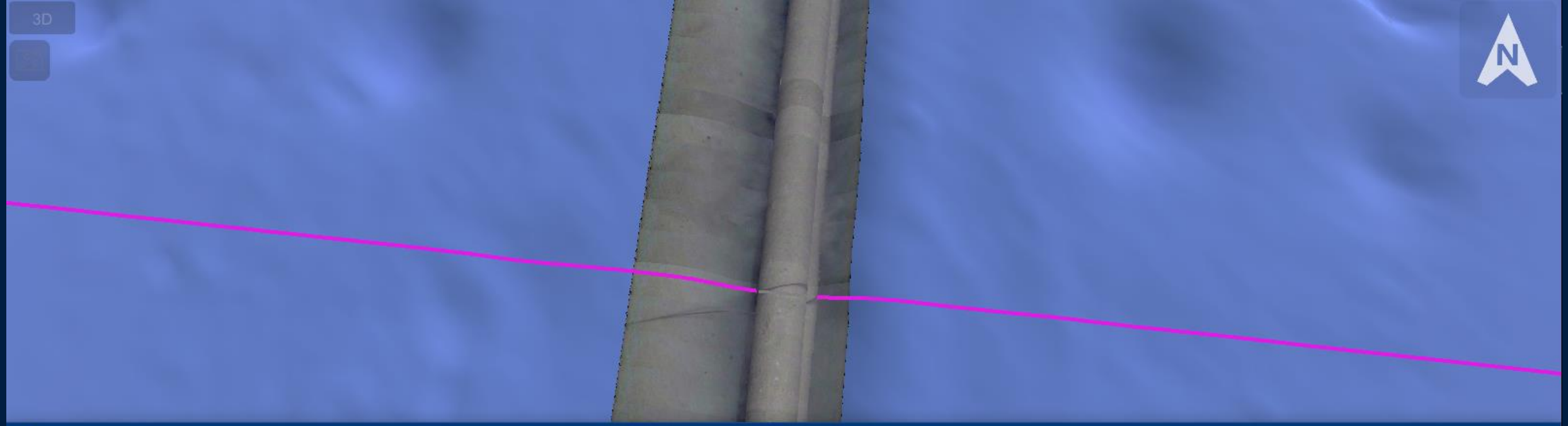
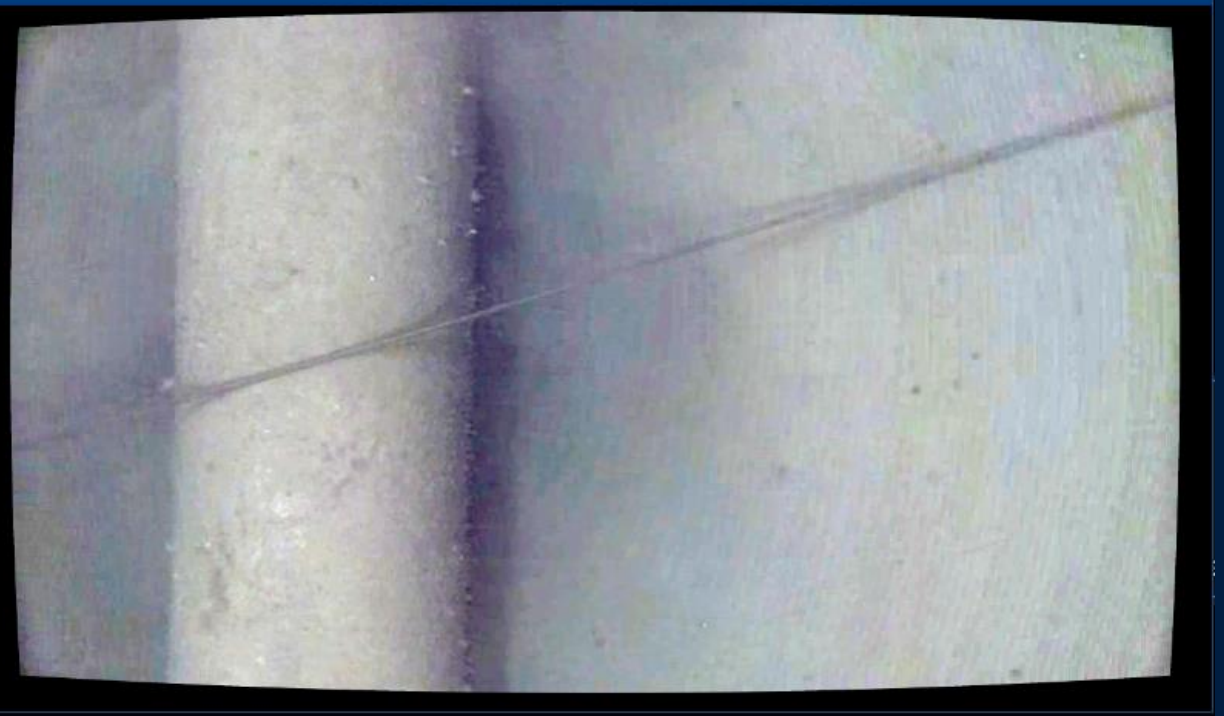
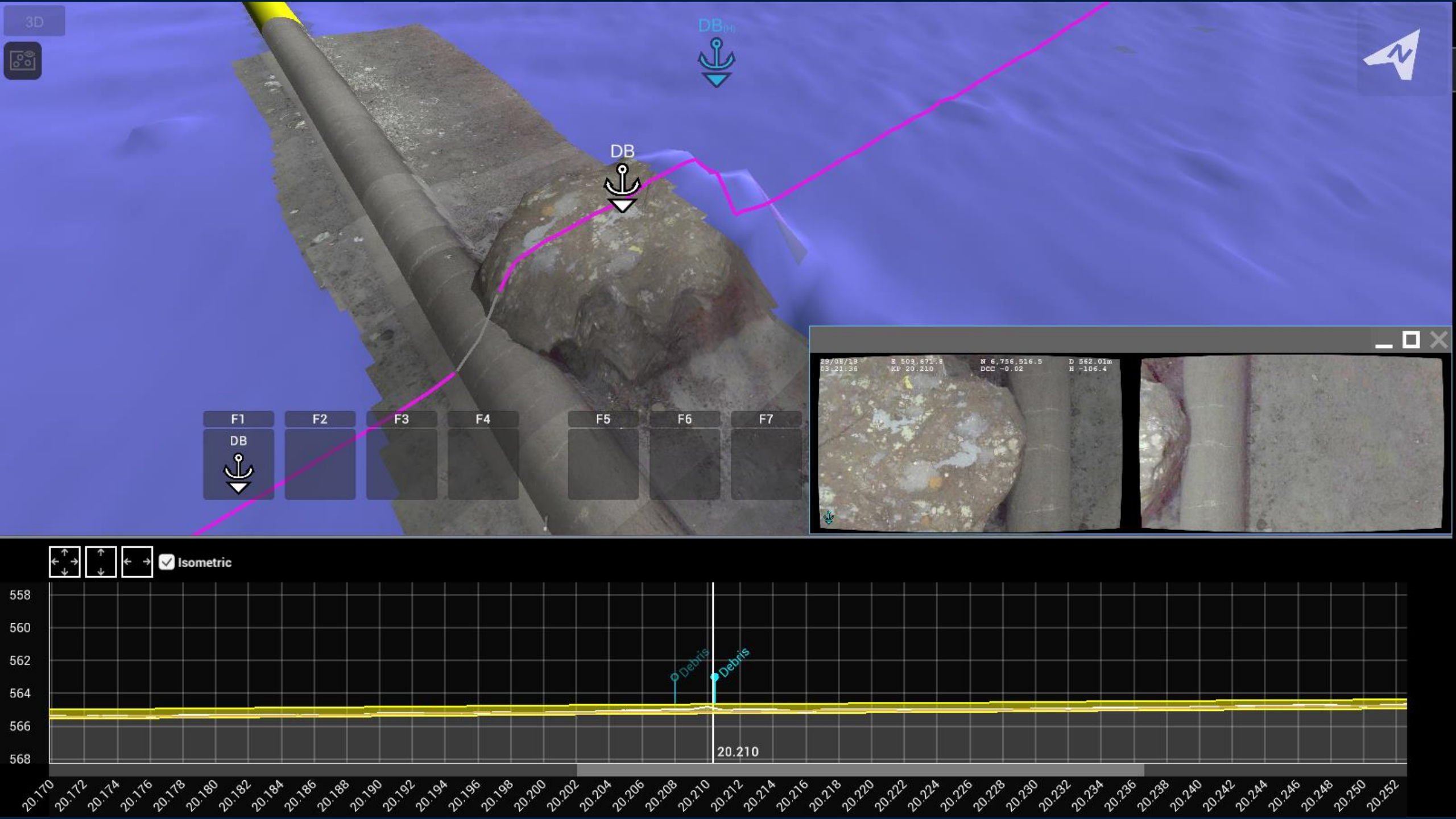
21.550
21.552
21.554
21.556
21.558
KP
21.510 KM



Imagery Preview




3D
DB(H)
DB
F1
F2
F3
F4
F5
F6
F7
DB
Isometric
558
560
562
564
566
568
Debris
Debris
20.210
20.170
20.172
20.174
20.176
20.178
20.180
20.182
20.184
20.186
20.188
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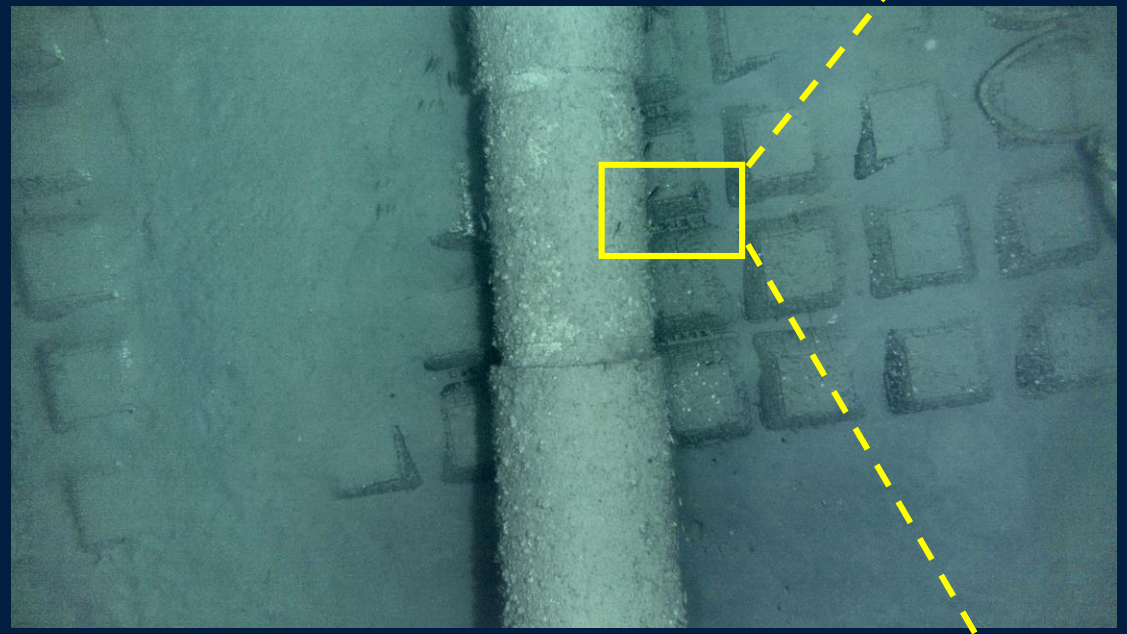
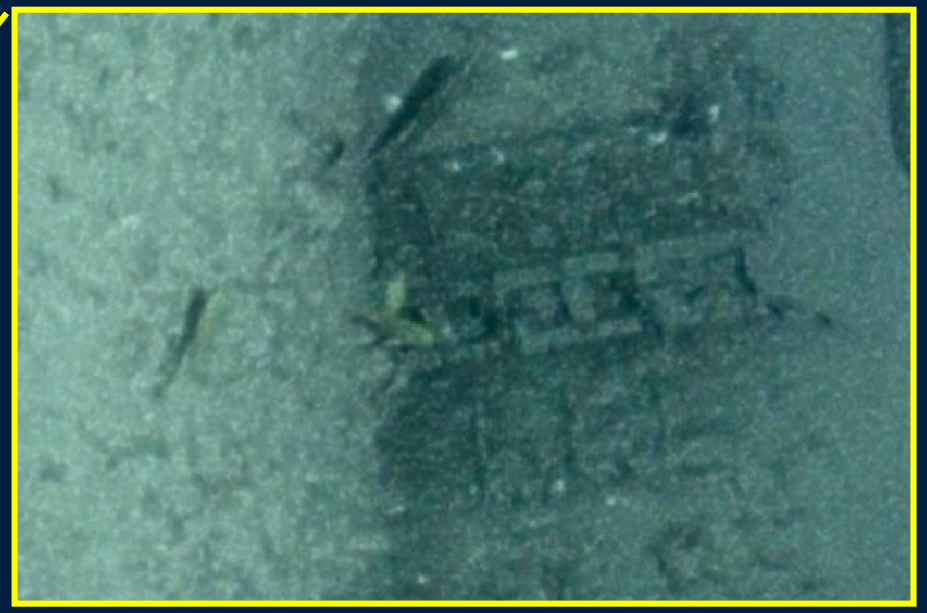
20.240
20.242
20.244
20.246
20.248
20.250
20.252

Image Comparison





Full Resolution

4096x2304

1.8 MB

Down-sampled

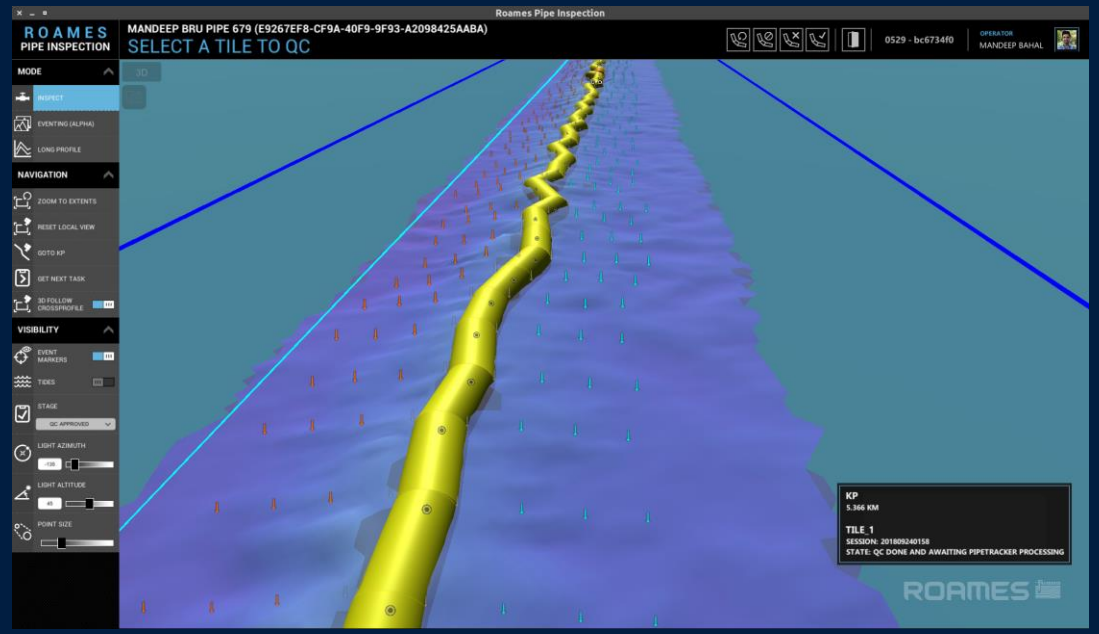
1600x900

147 KB

Note: Image decimation is employed to enable efficient transfer of data from the vessel in near-real time only. Full resolution images can be ingested into the system at the final deliverable stage.

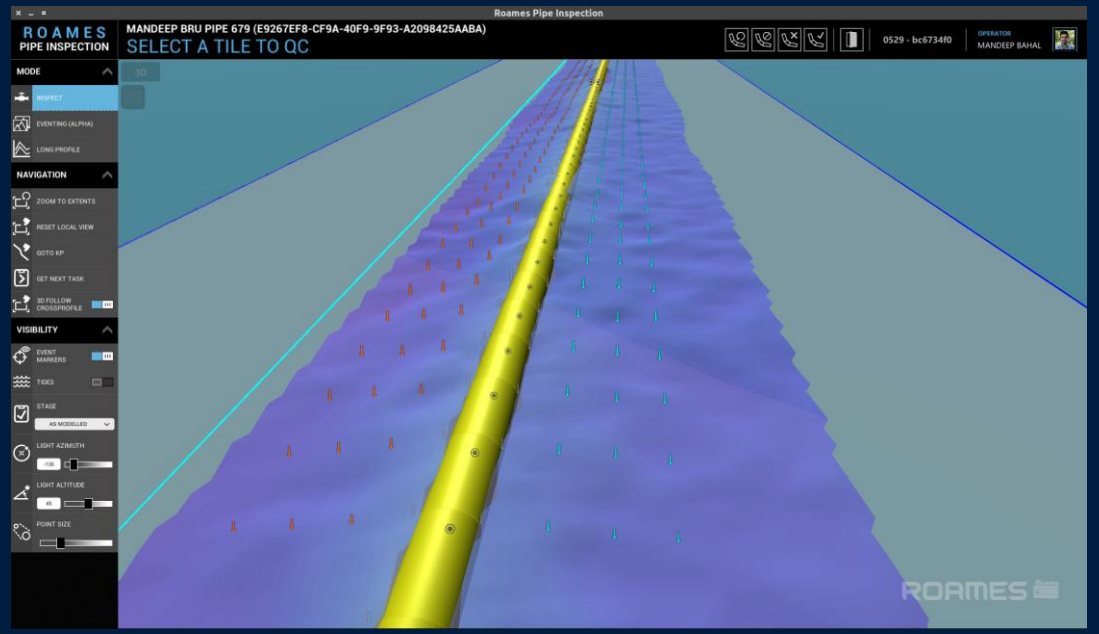
Position re-ingestion

Expedited Upload (minutes after acquisition)



Coarse INS position (grossly exaggerated) uploaded minutes after acquisition

Delayed Upload (hours after acquisition)



Fully processed INS positioning can be re-ingested and the results are propagated through the entire system automatically