Noah’s Ark- NUH_UN GEMİSI

Project Noah – Utilizing LiDAR, Photogrammetry, Ground Penetrating Radar and Thermography Reality Capture Mapping technologies for subsurface geospatial investigation in archaeological applications

THANK YOU!

A special thank you to all the contributors for this incredible archeological survey. The ToPa 3D team brought together the best of class in the industry to perform multiple surveys utilizing 'Reality Capture' technologies, providing a full 3D model of both surface and sub-surface data.

BIGMAN GEOPHYSICAL

Bigman Geophysical – providing GPR Training, Interpretation and Animations

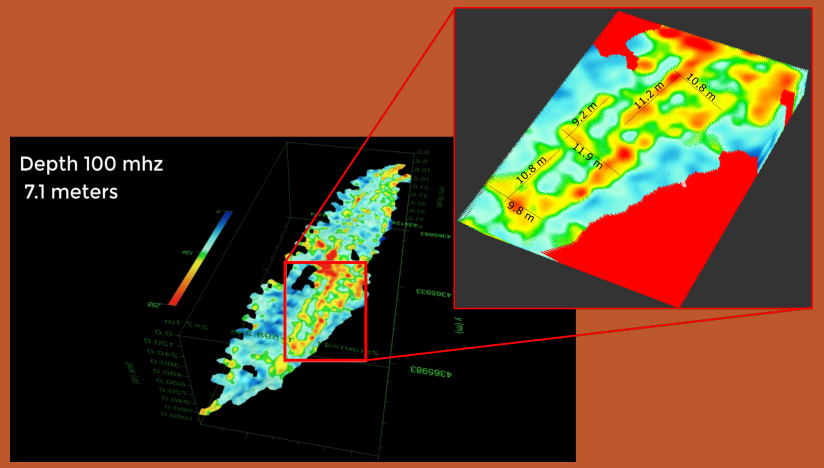
ToPa3D

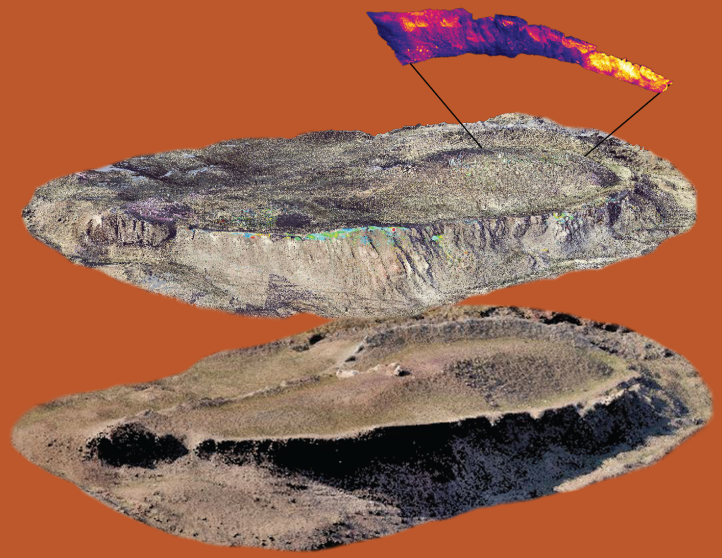
ToPa 3D – providing project management, Logistics, LiDAR, Thermography, Graphics, and GPR field collection

Concrete GPR – providing GPR field collection and software training for GPR interpretation

Sensors & Software

Sensors & Software – providing long-range GPR sensor equipment





LiDAR + GPR

Thermography

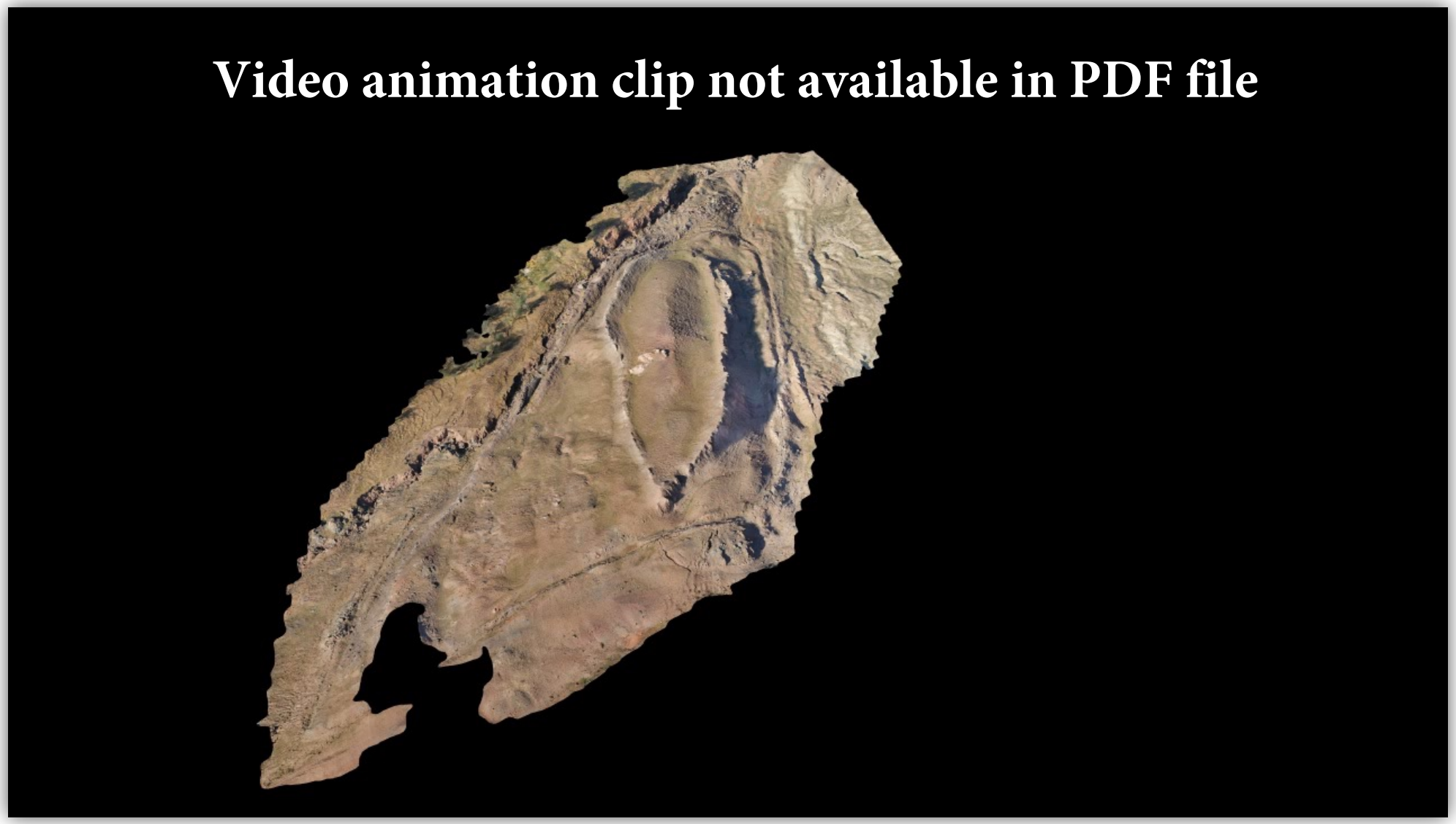
sUAS Mapping

sUAS (drone)

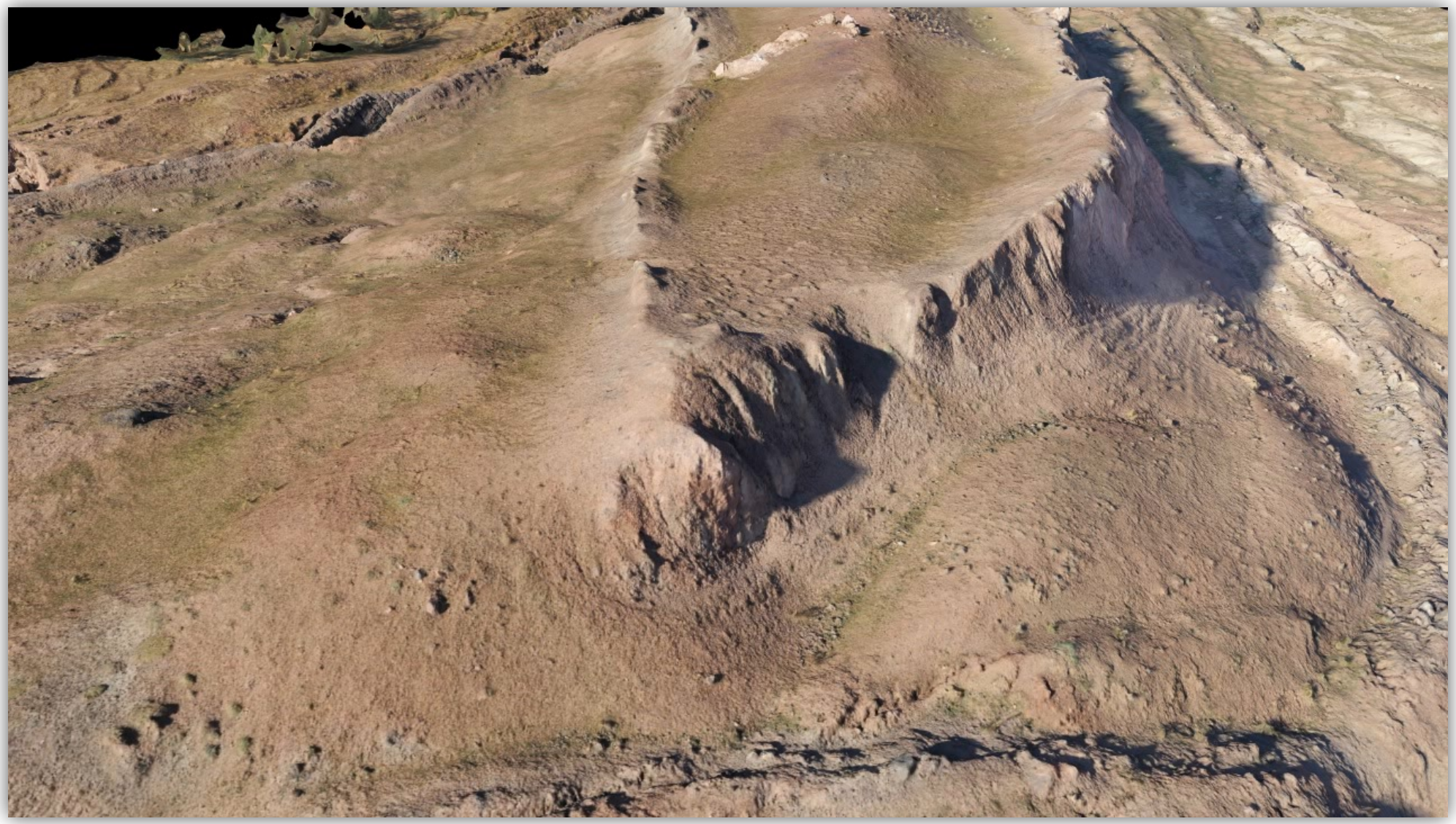
Drone Data

Small Unmanned Aerial Vehicle data from a DJI Mavic 2 Pro drone collected imagery that was stitched photogrammetrically with Pix4D software depicting in detail, the rugged topography of the project site. Data was not aligned to control points. Geotagged images from the internal GPS unit provided. Typical precision expected with this internal unit without ground control points range from 1-2 meters horizonal, and 1-3 meters vertical. This tool was primarily used for visualization purposes.

ANIMATION



ANIMATION



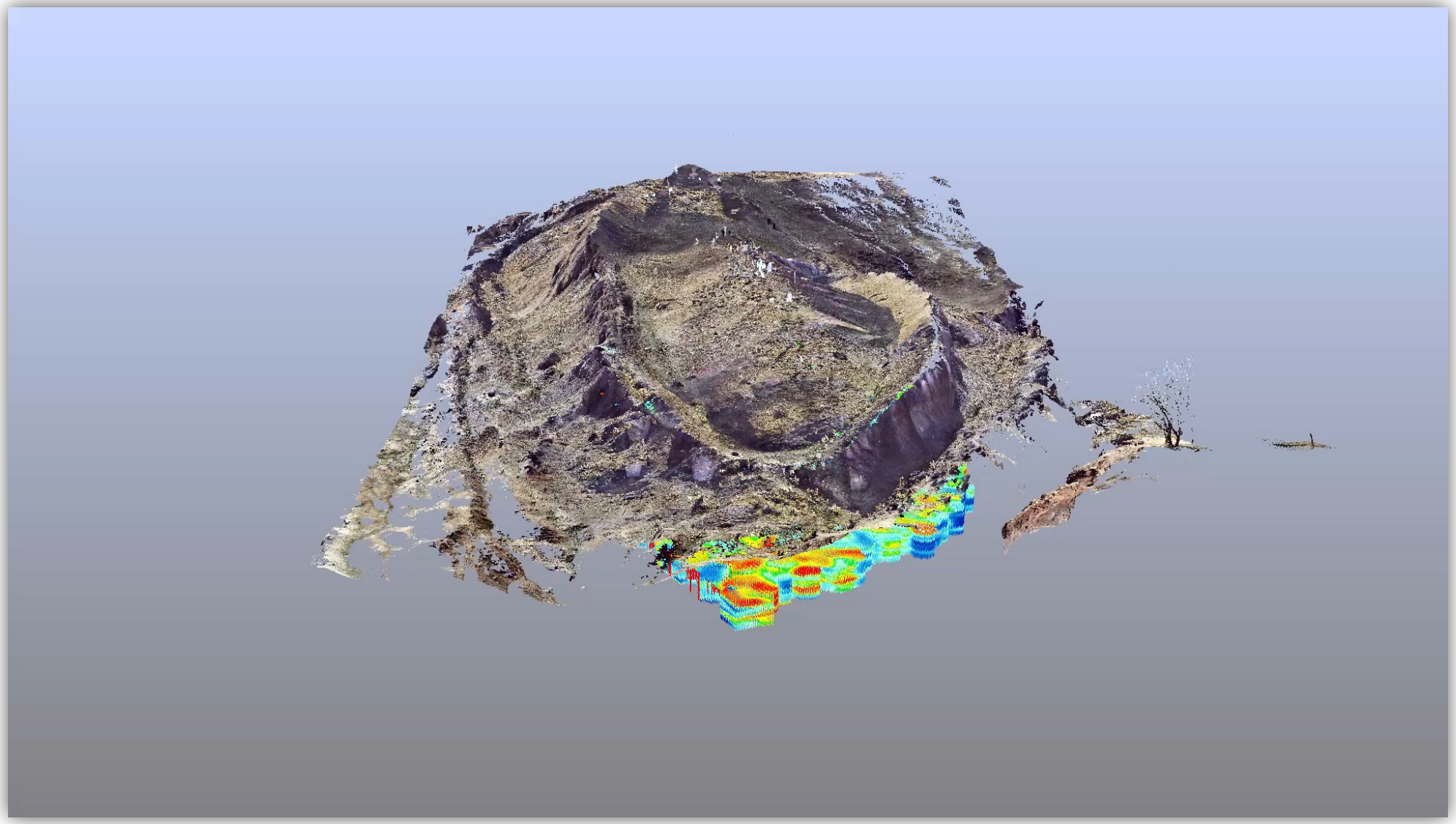
LiDAR

LIDAR (light detection and ranging)

LiDAR data was collected from a FARO terrestrial laser scanner at ¼ resolution and x3 noise compression and processed in FARO Scene V2019.1 software. 111 scans were collected and registered (stitched) together creating a complete 3D model (point cloud) that is measurable within approximately 1”. The point cloud data was aligned to survey control, established by a local Turkish surveying firm using a GPS unit (+/-1” precision) without base station. This point cloud data will be used for archaeological grid layout for planning future excavations or analysis.

Point cloud data has been overlaid on GPR and thermal data to produce scaled imagery for geolocating subsurface energy returns of interest.

ANIMATION



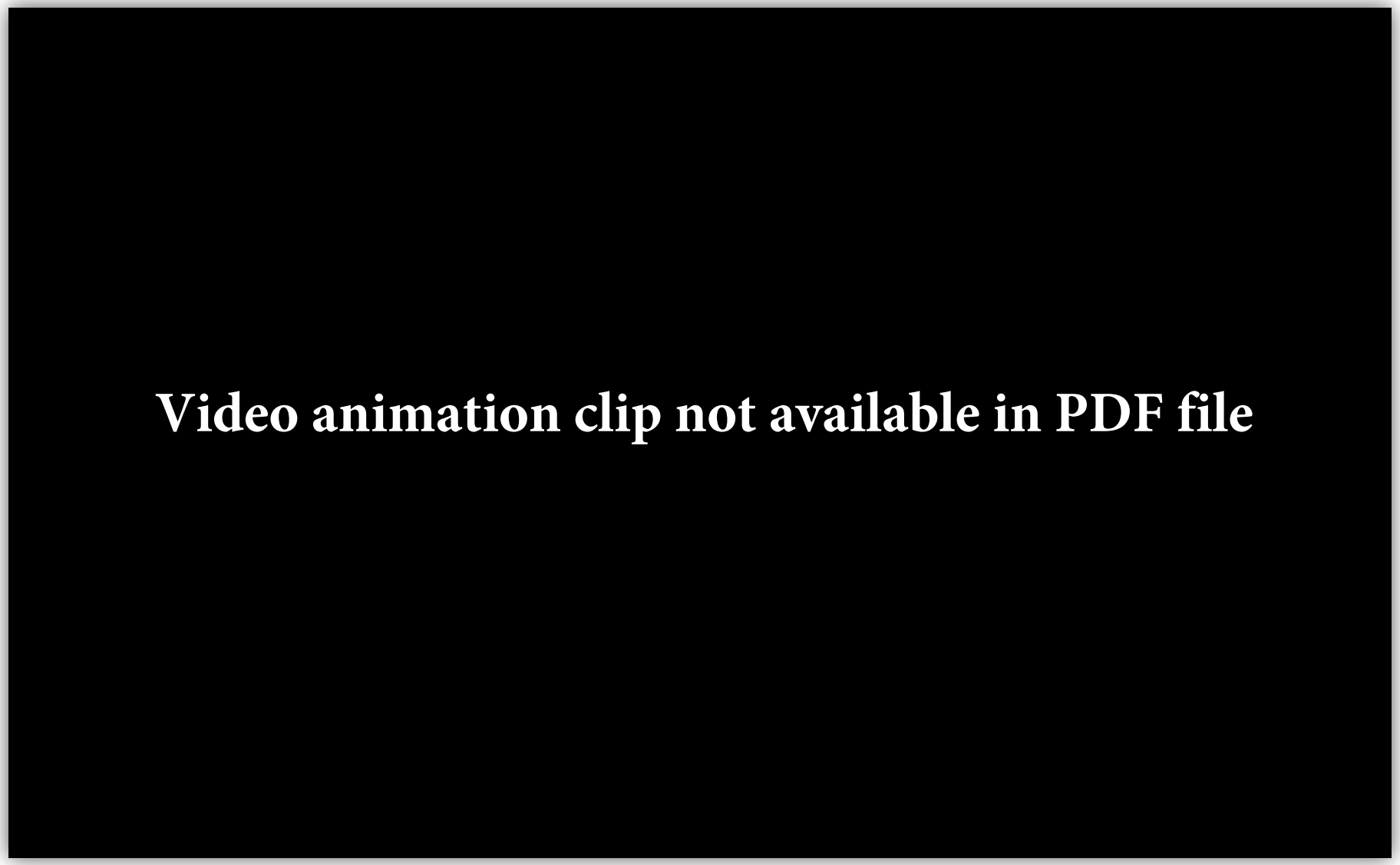
Ground-Penetrating Radar (GPR)

GPR

All data were processes using GPR-Slice v.7 software. A vertical correction for data drift was first applied to all wiggle traces using a batch-wobble minus gain function. Then a time-zero correction was applied to data to adjust data lines to correspond with the ground surface reflection. Next a bandpass and background filter were applied to remove high and low frequency noise and remove horizontal banding from data profiles. Amplitudes were adjusted using an AGC automated gain function. A hyperbola fit was conducted, and data were migrated to account for signal distortion during data acquisition. Finally, a Hilbert transform was applied to generate absolute amplitudes for reflection responses.

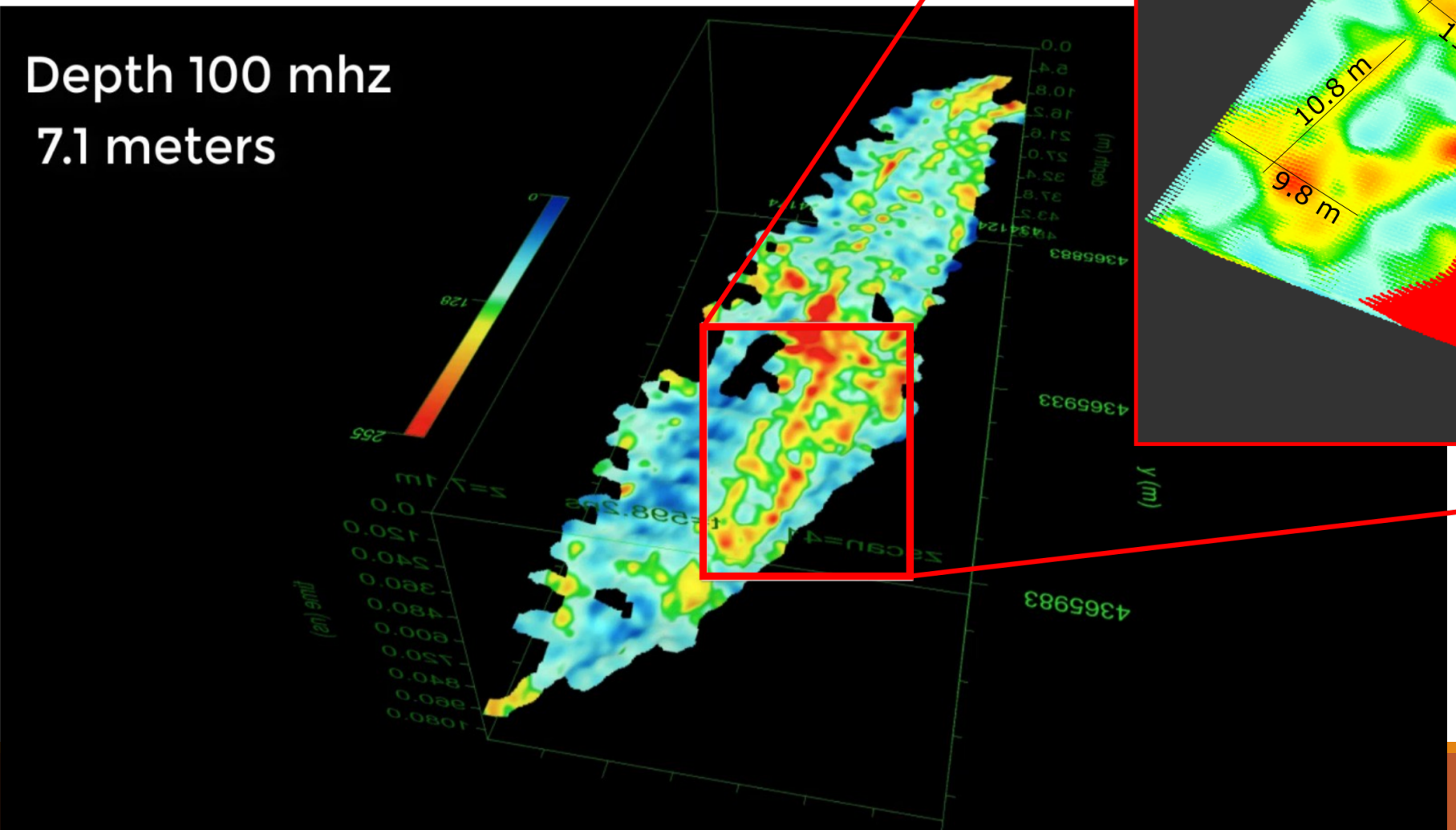
Dr. Dan Bigman – Bigman Geophysical

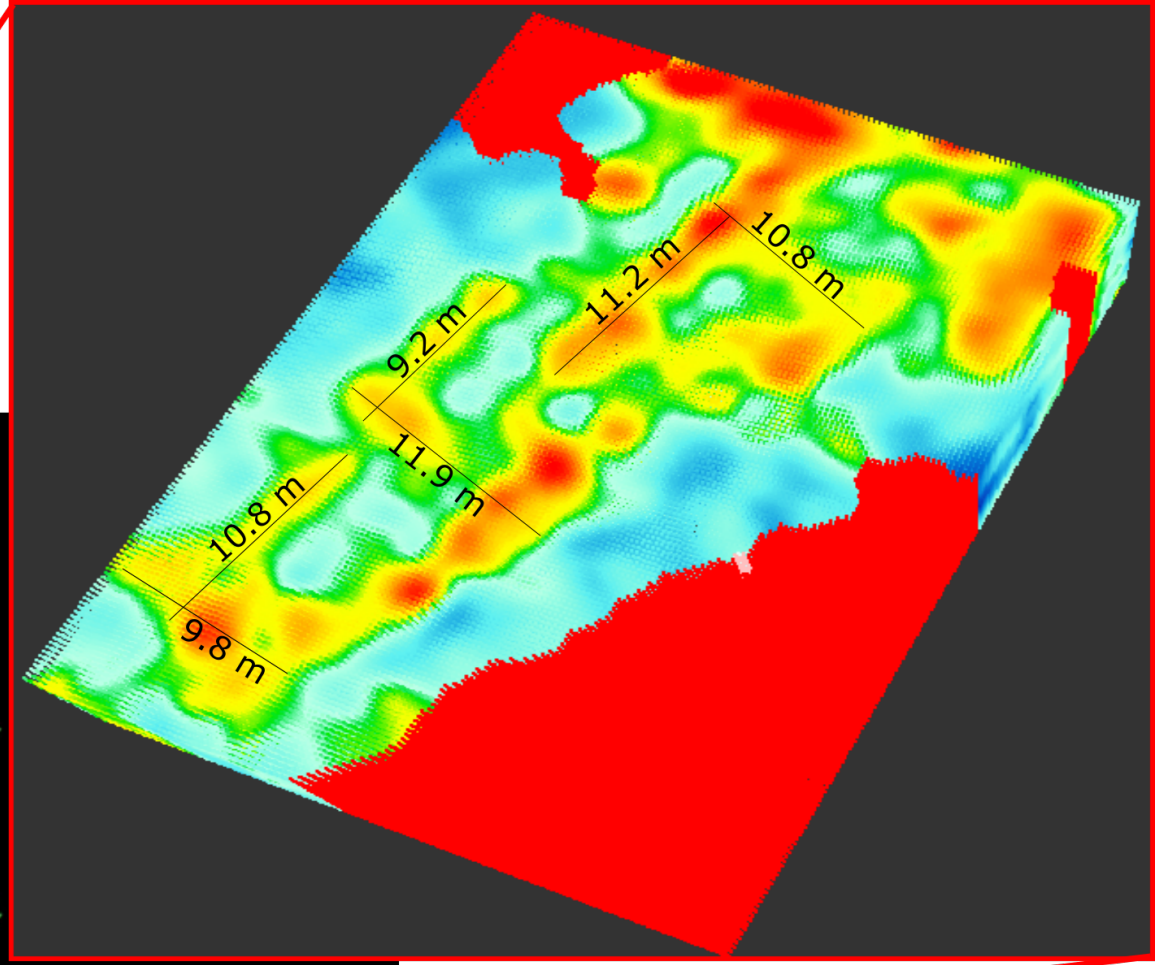
ANIMATION

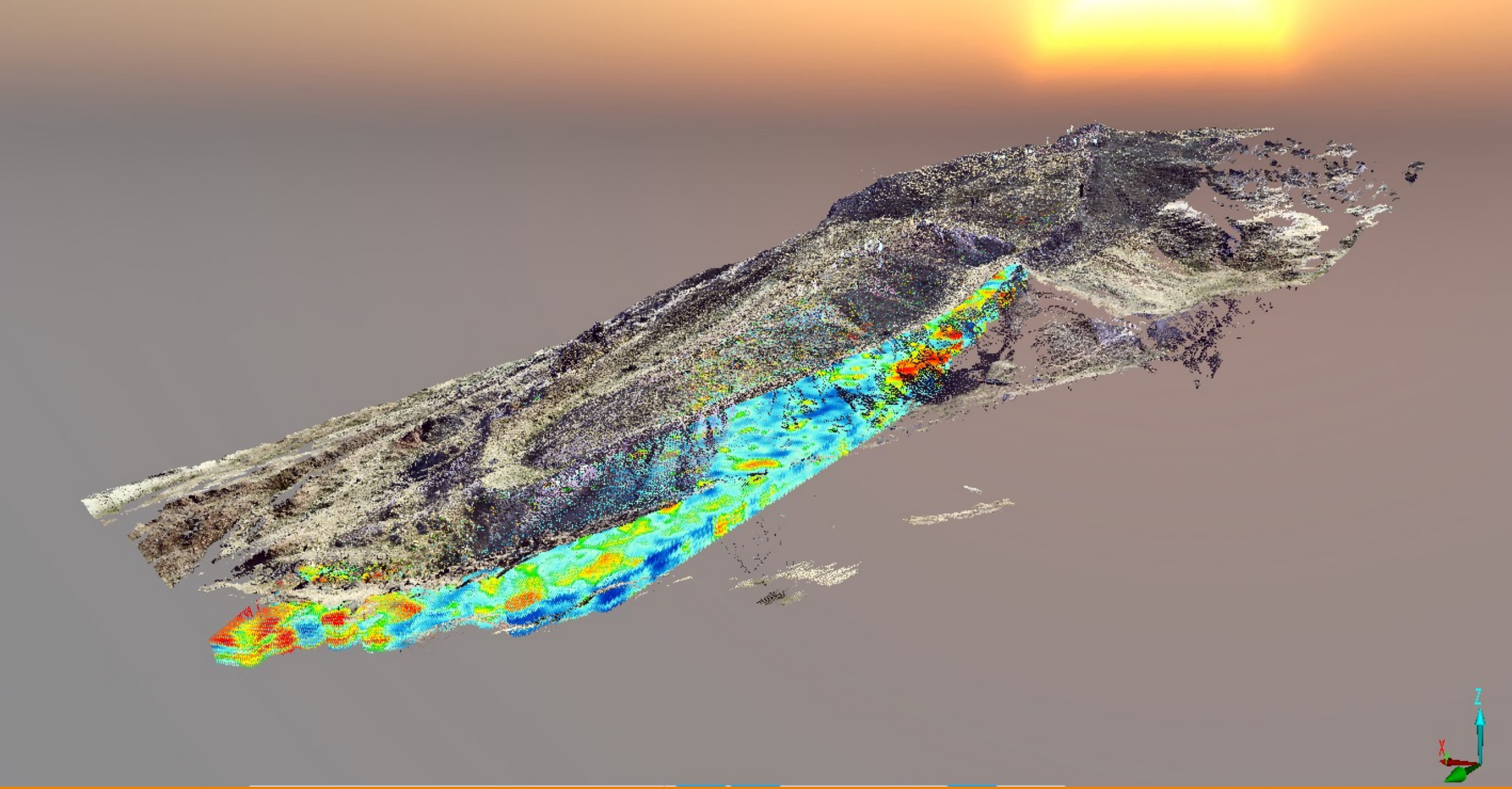


AREAS OF INTEREST AT 7.1 METERS DEPTH

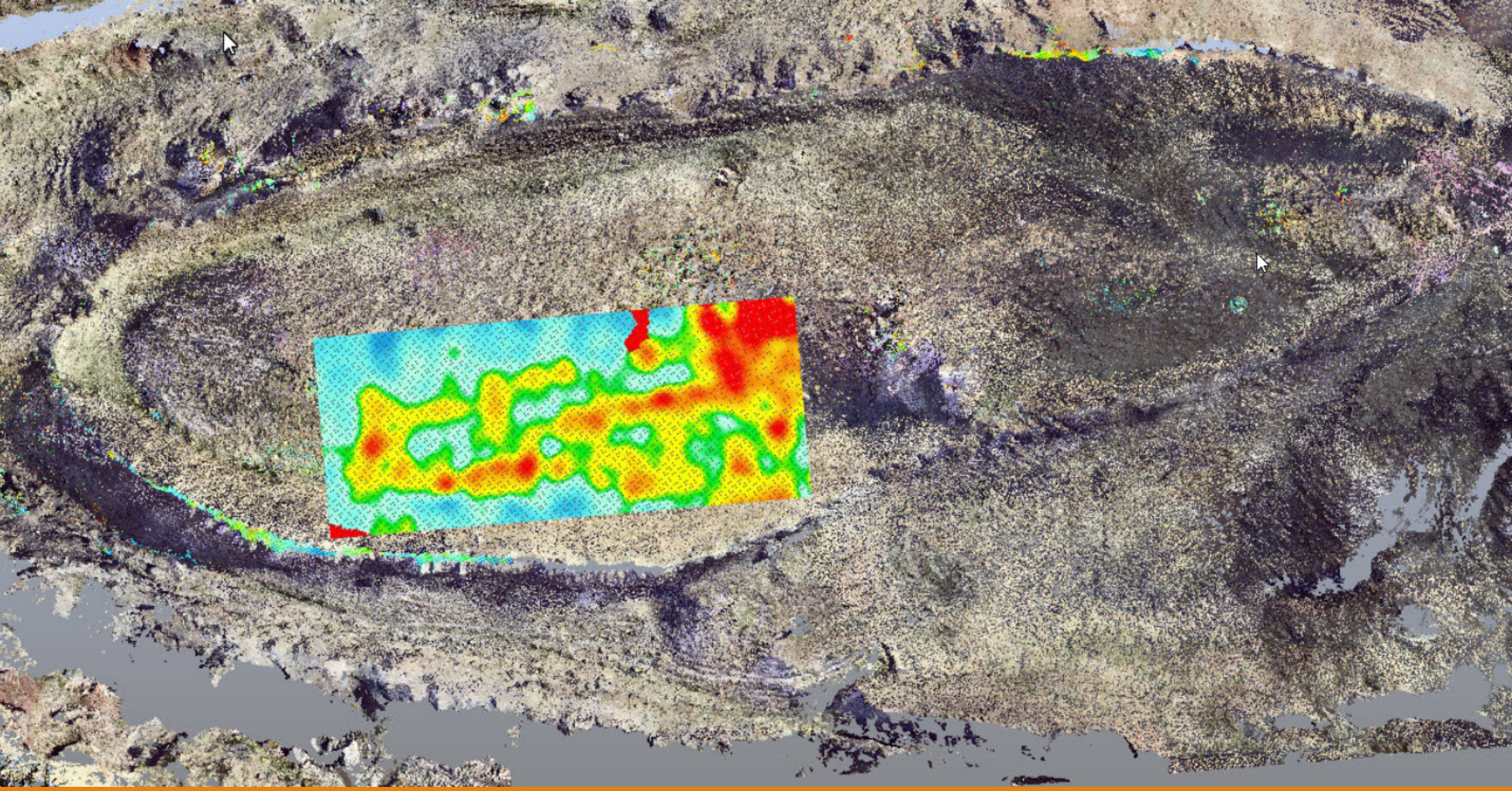
RECTANGULAR SHAPED RETURNS DEPICT GEOMETRIC STRUCTURE IN THE ROCK (NATURAL OR MAN-MADE CANNOT BE DETERMINED)





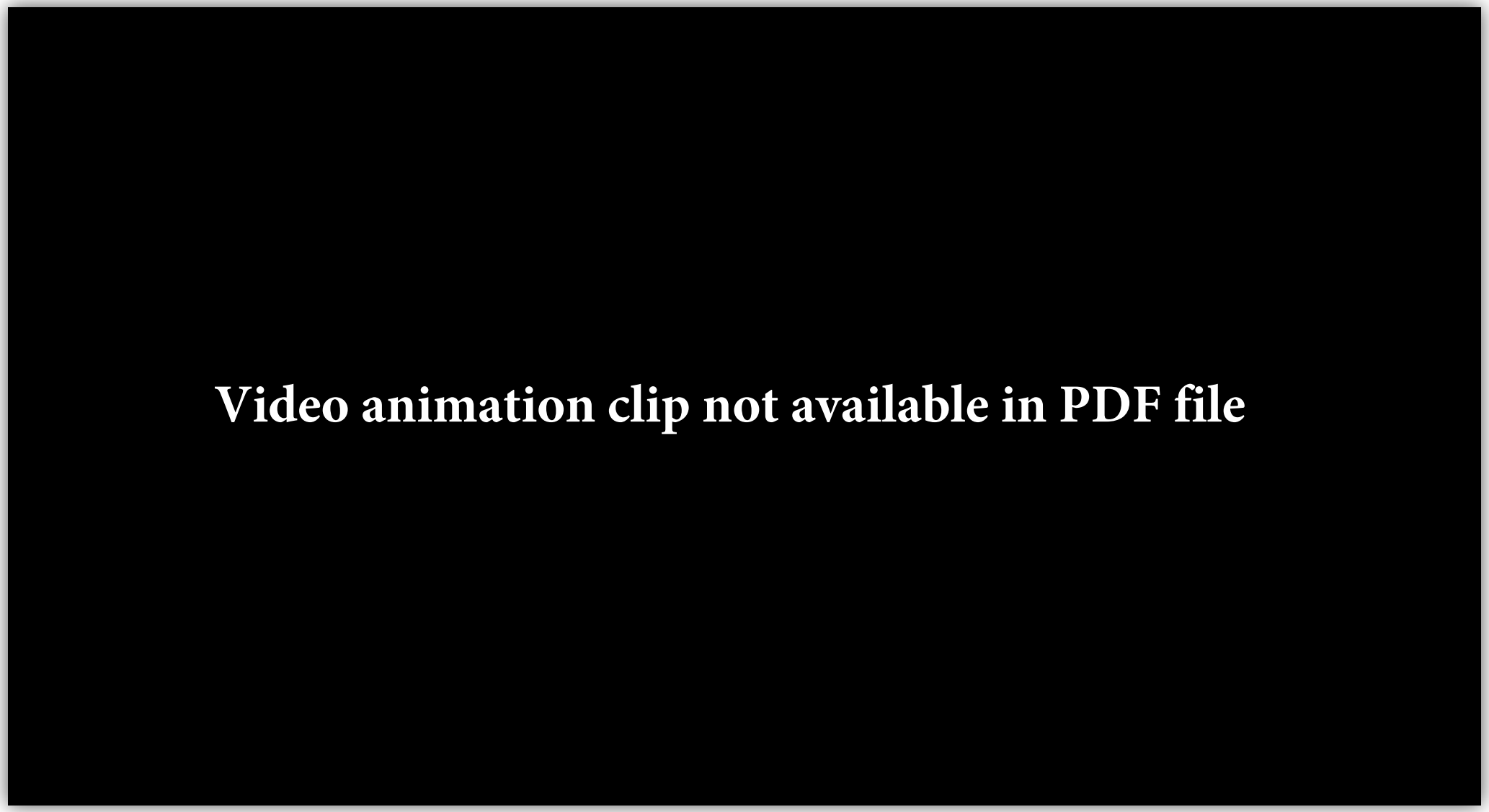


LIDAR + GPR



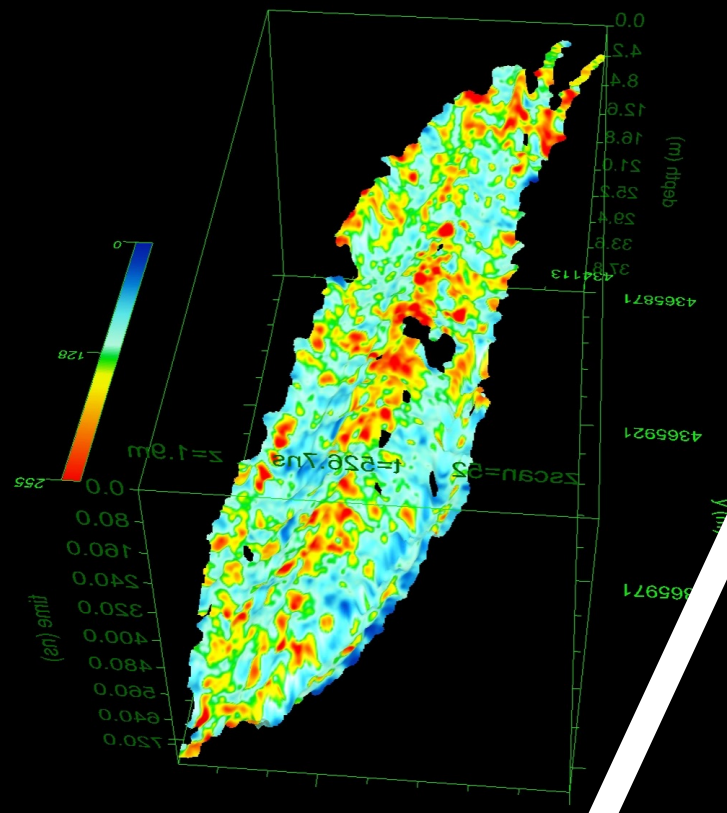
AREA OF INTEREST

ANIMATION



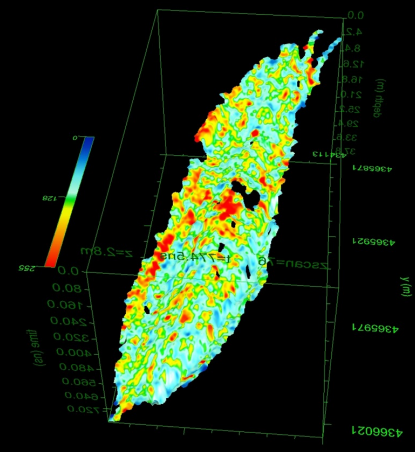
250 MHZ

1.9 METERS DEPTH



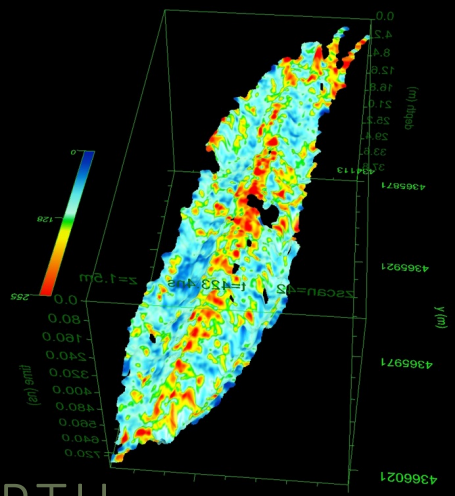
250 MHZ

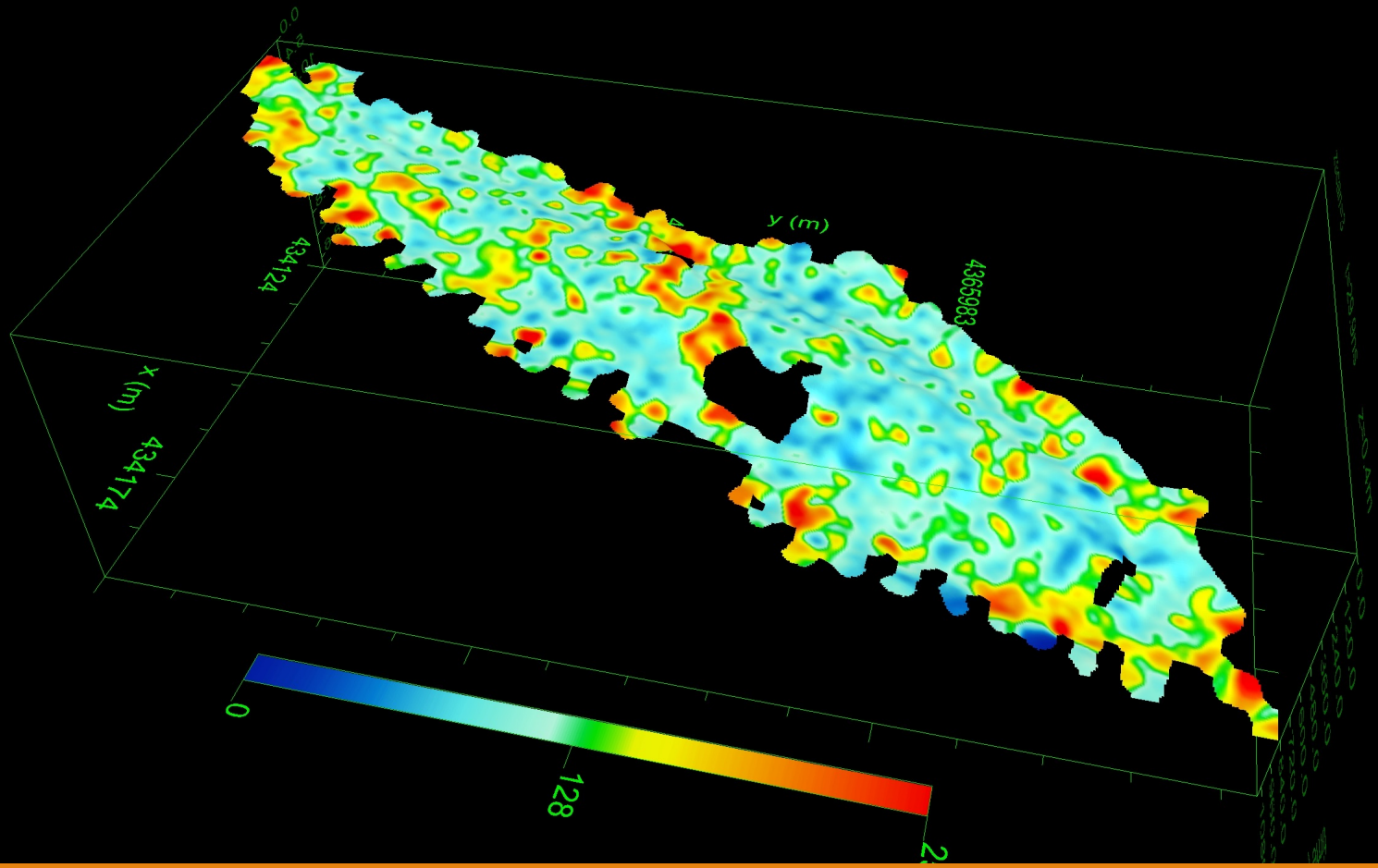
2.8 METERS DEPTH



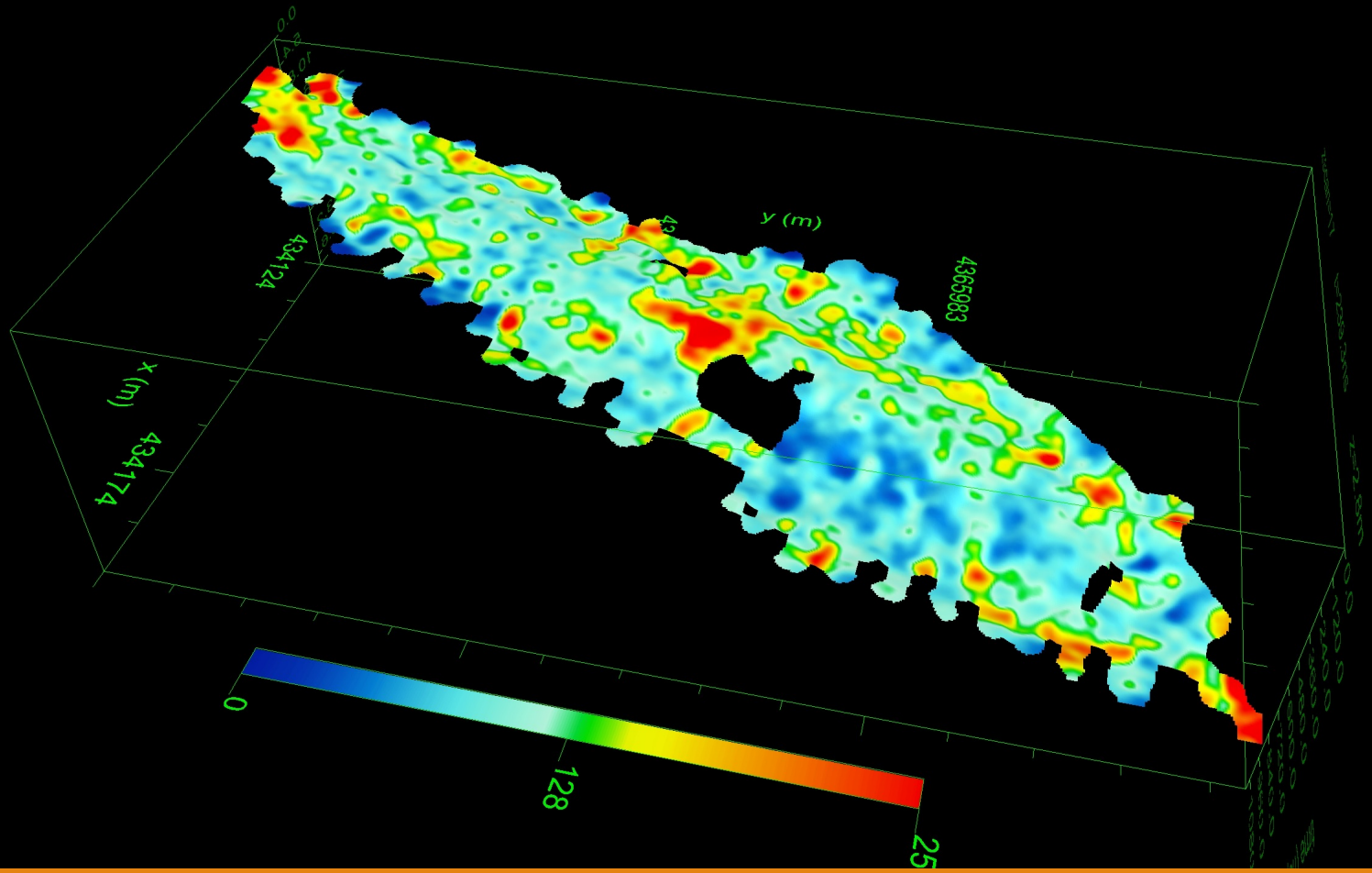
250 MHZ

1.5 METERS DEPTH

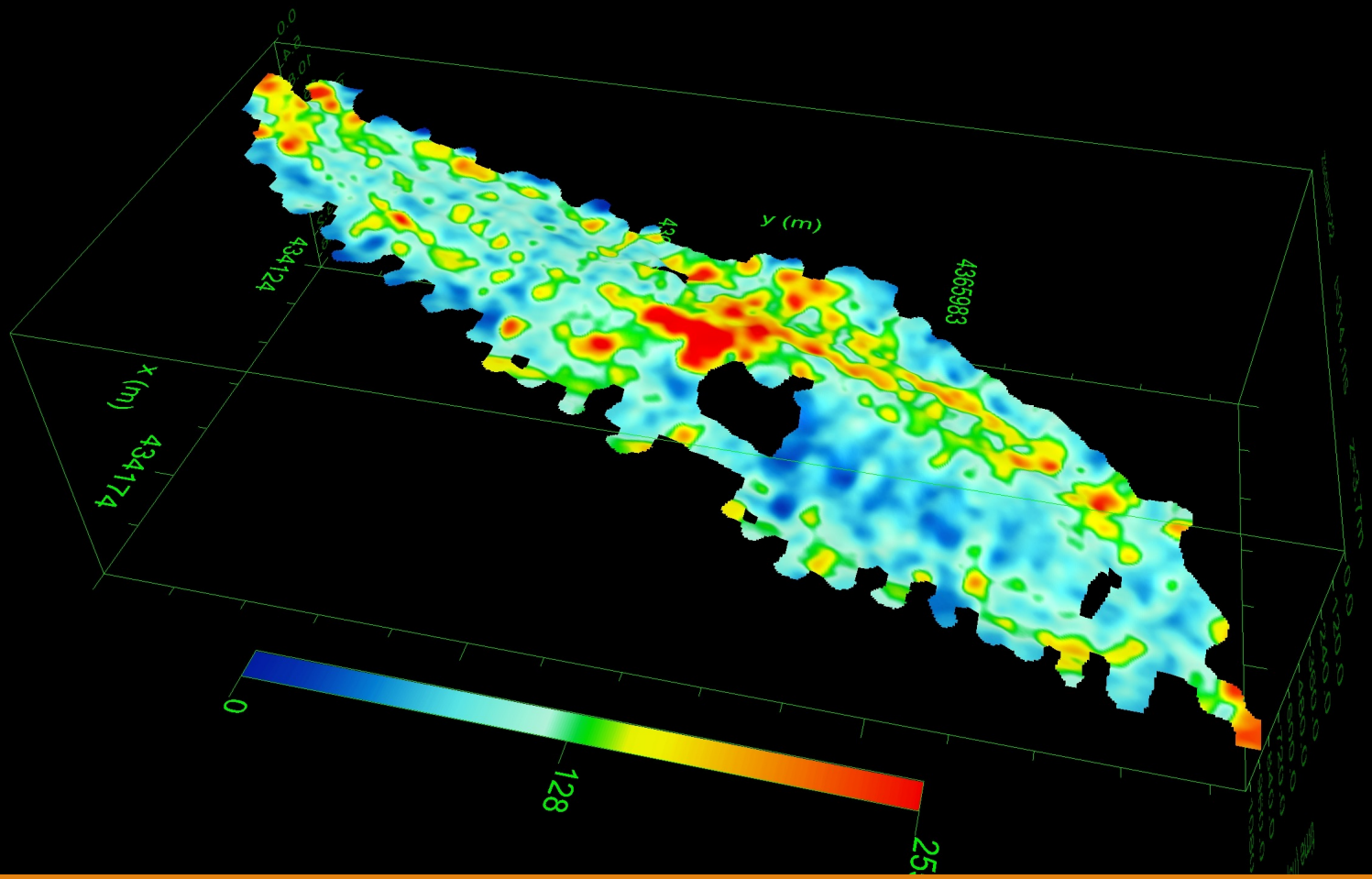




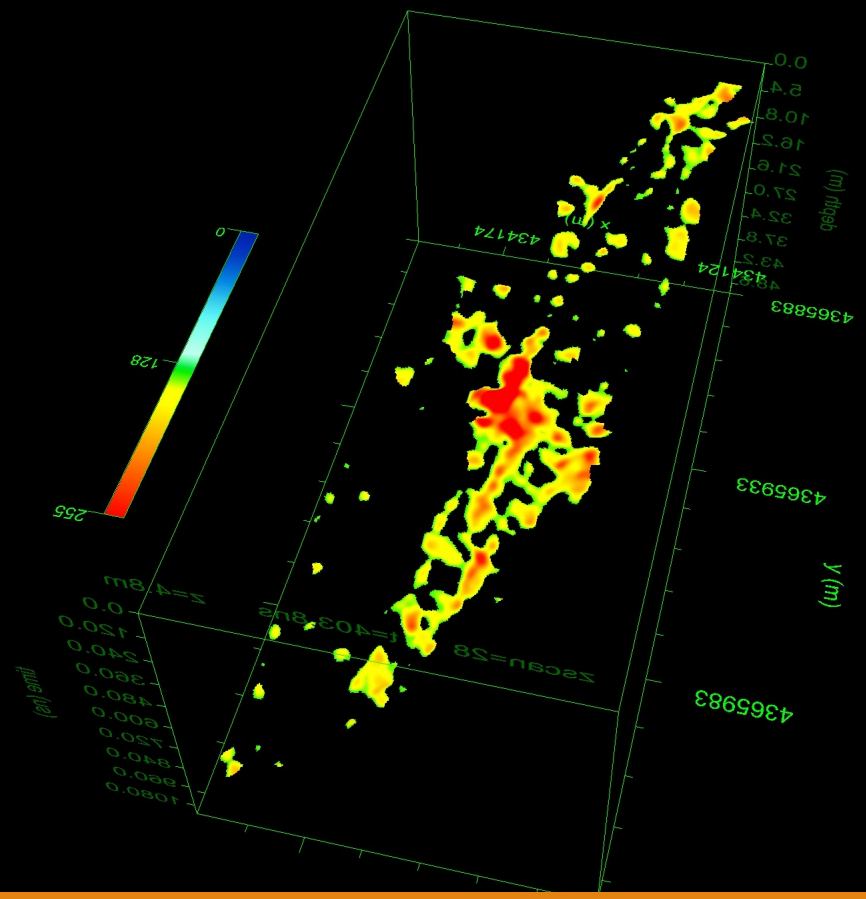
100 MHZ - 0.4 METERS



100 MHZ – 2.8 METERS

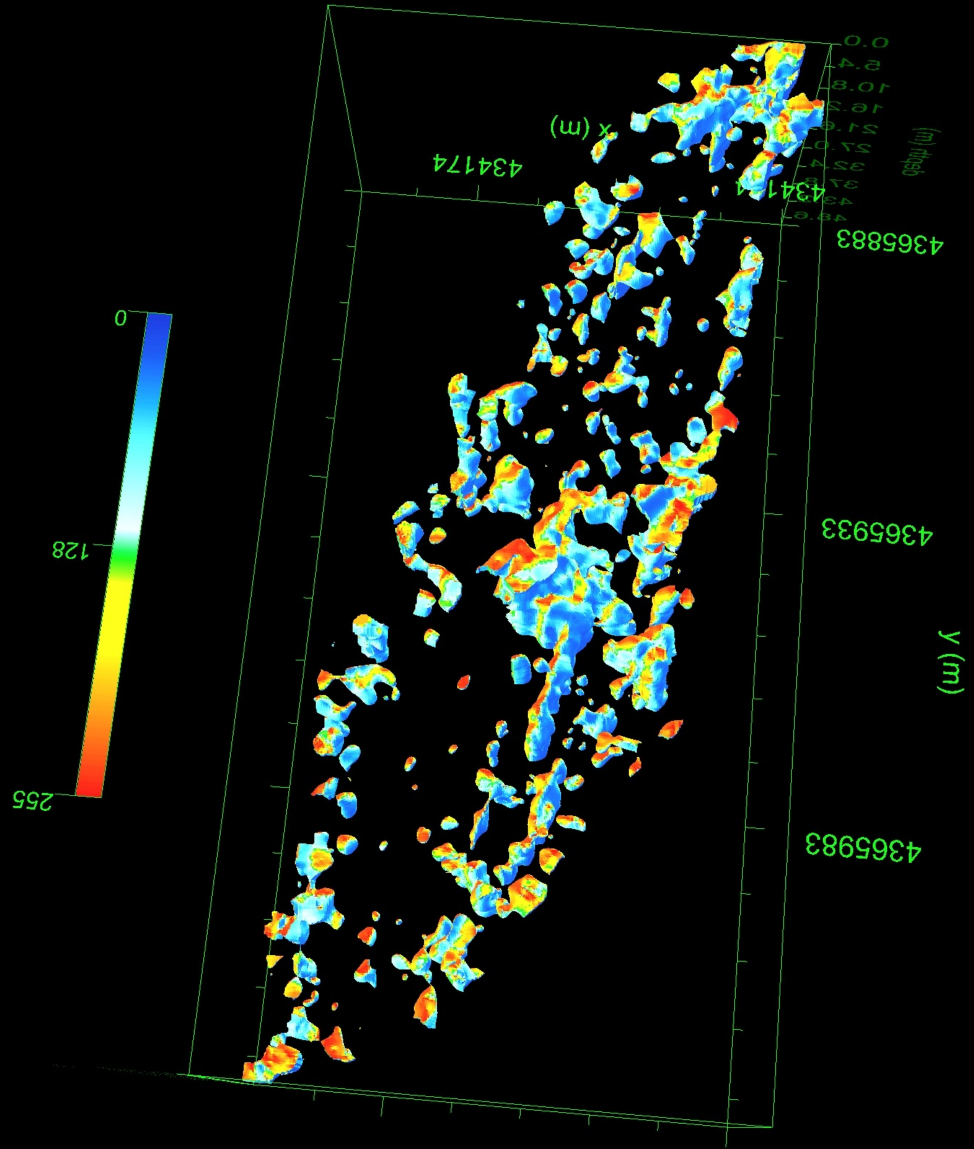


100 MHZ – 3.7 METERS

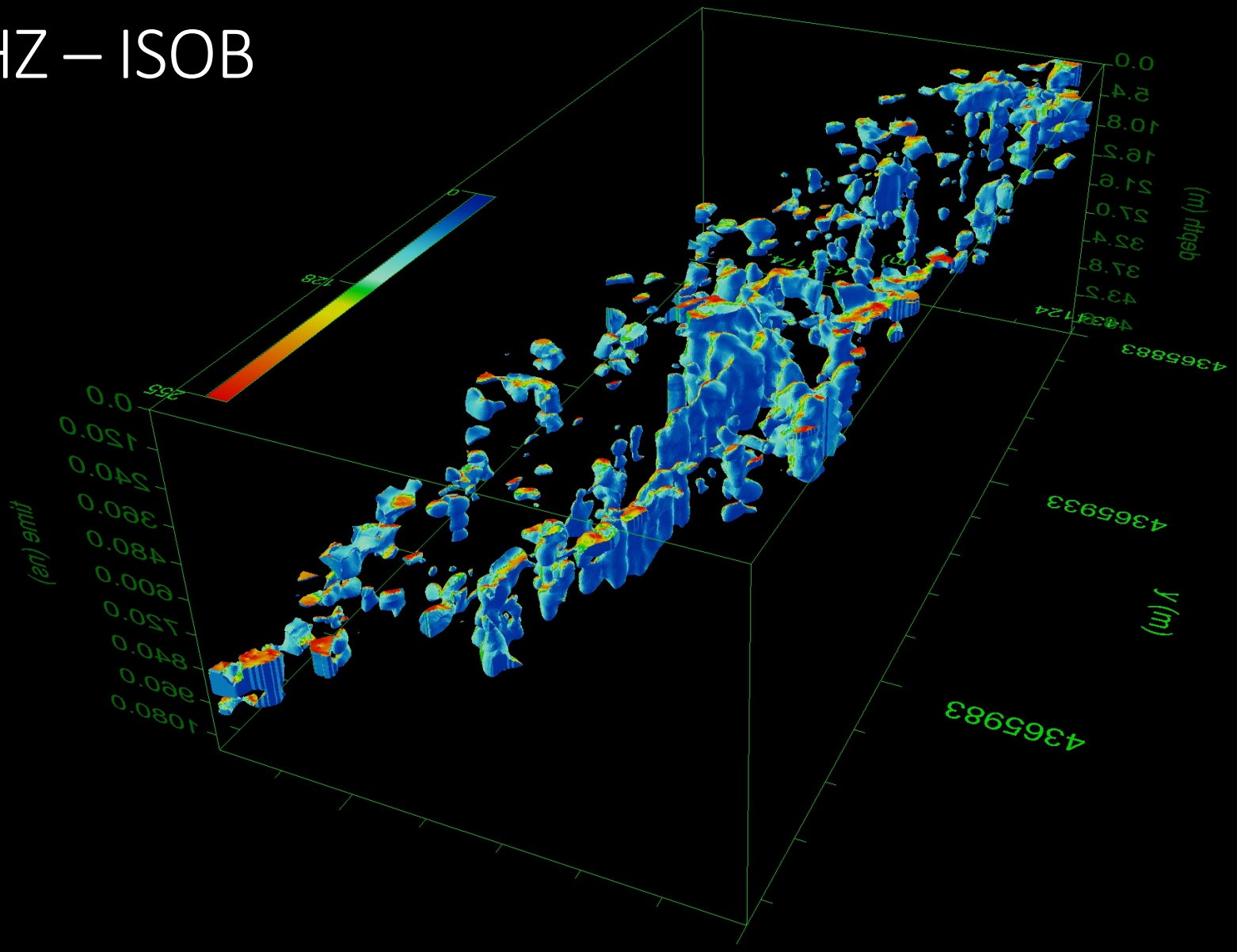


100 MHZ – 4.8 METERS

100 MHZ – ISOA



100 MHZ – ISOB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360.0
480.0
600.0
720.0
840.0
960.0
1080.0
time (ns)
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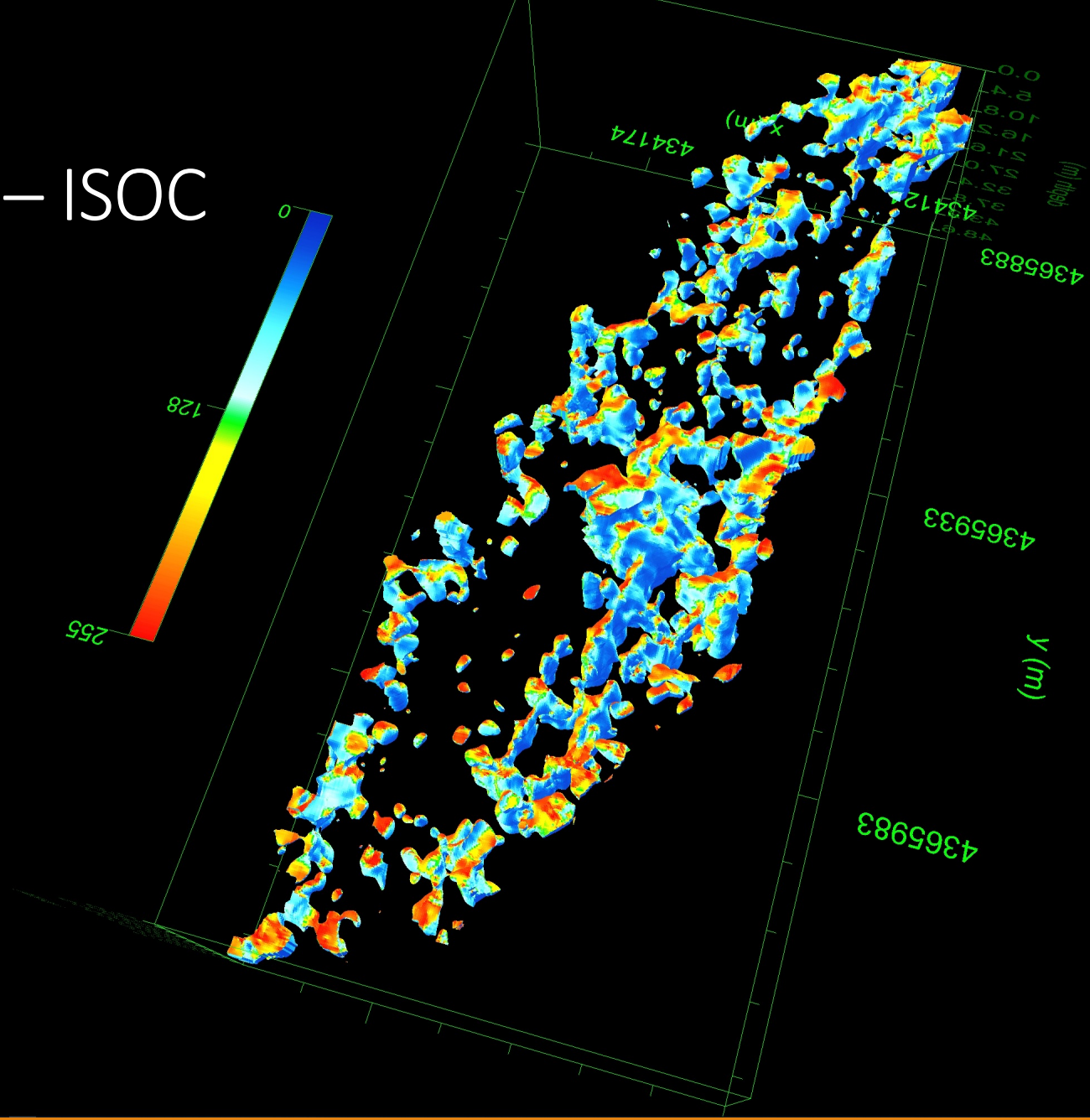
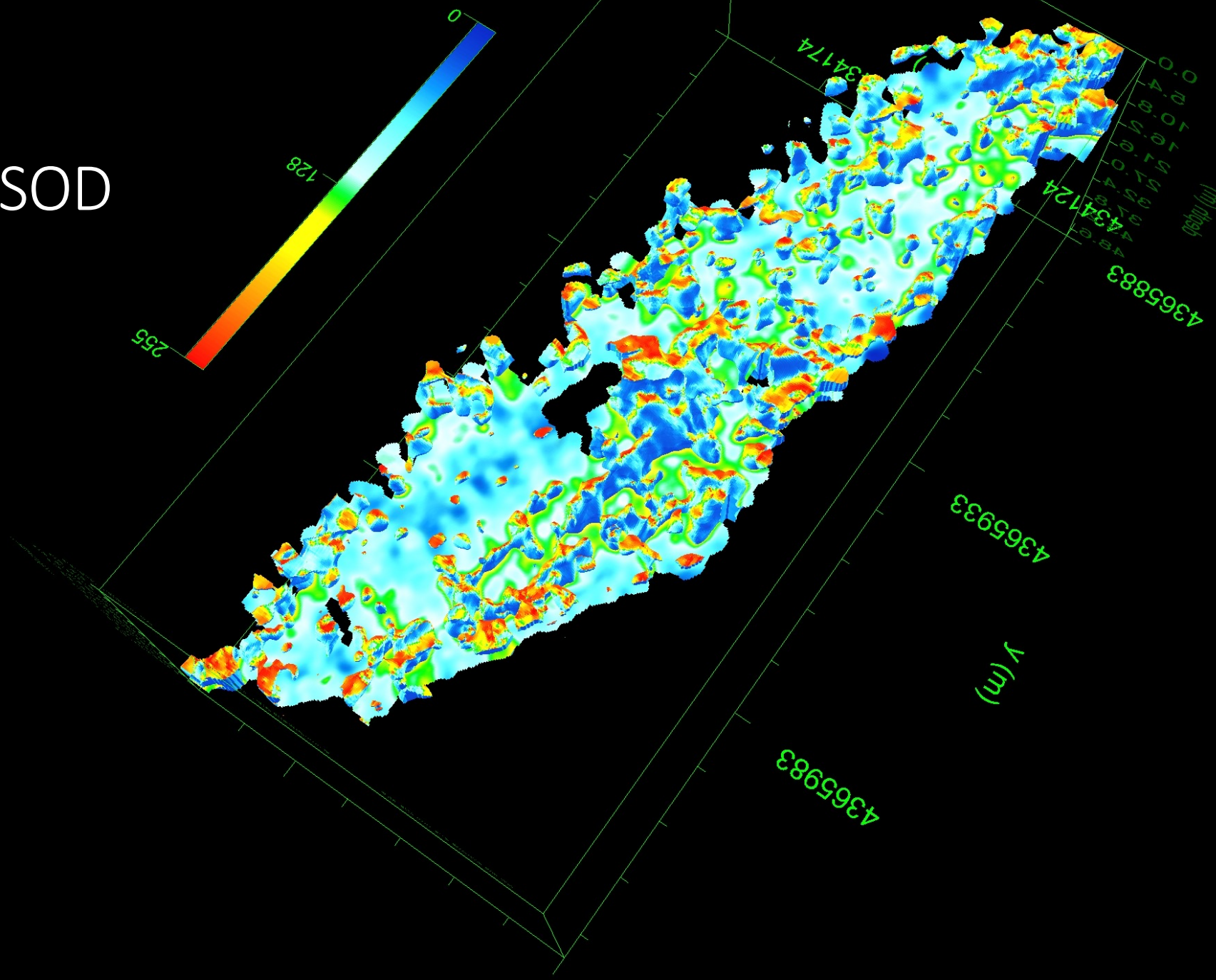
4365933
4365983
y (m)
0.0
5.4
10.8
16.2
21.6
27.0
32.4
37.8
43.2
depth (m)

100 MHZ – ISOC



100 MHZ – ISOD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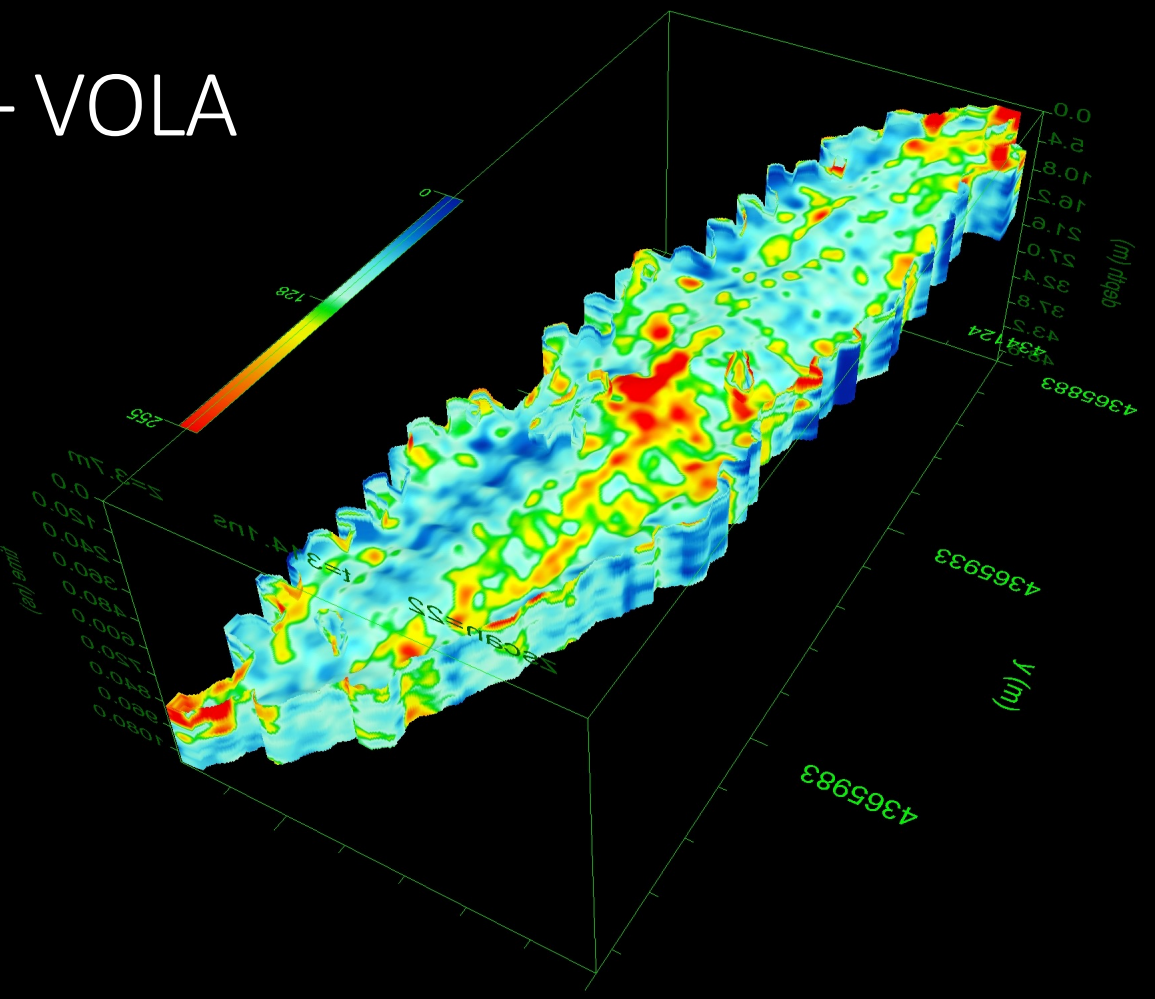
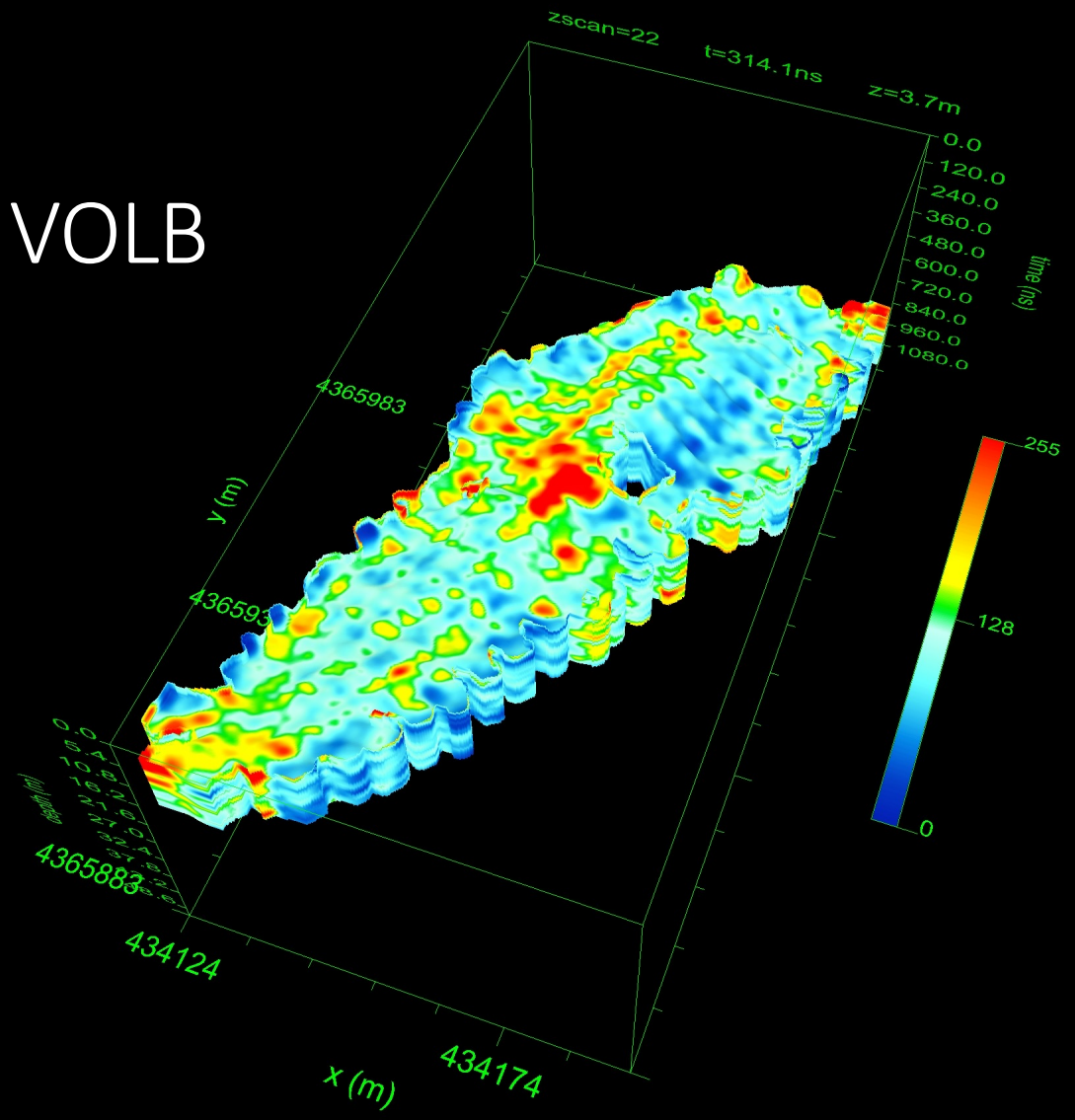
y (m)
depth (m)

100 MHZ – VOLA



100 MHZ – VOLB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y (m)
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x (m)
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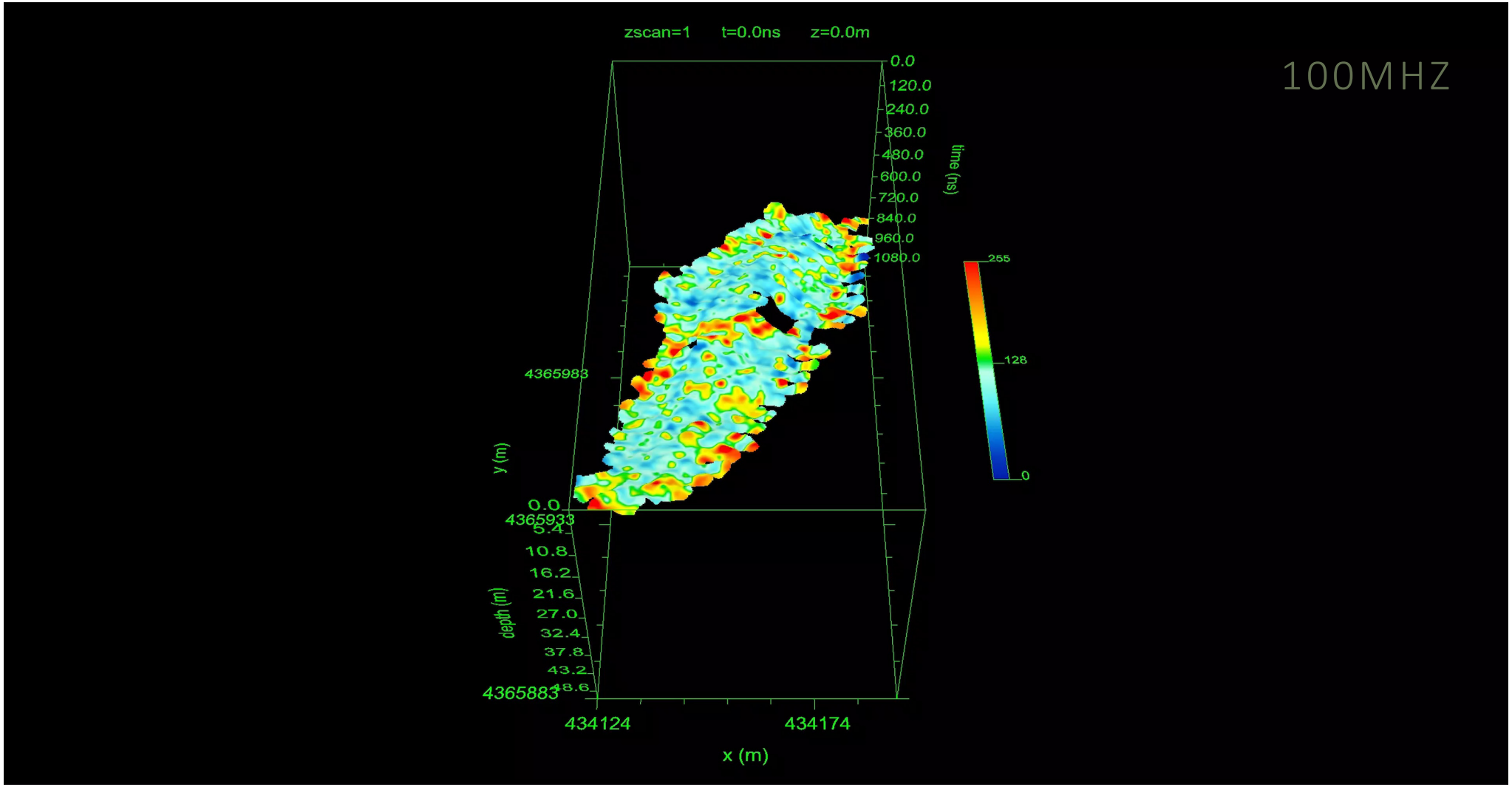
255
128
0

ANIMATION

ANIMATION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time (ns)
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y (m)
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10.8
16.2
21.6
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depth (m)
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x (m)
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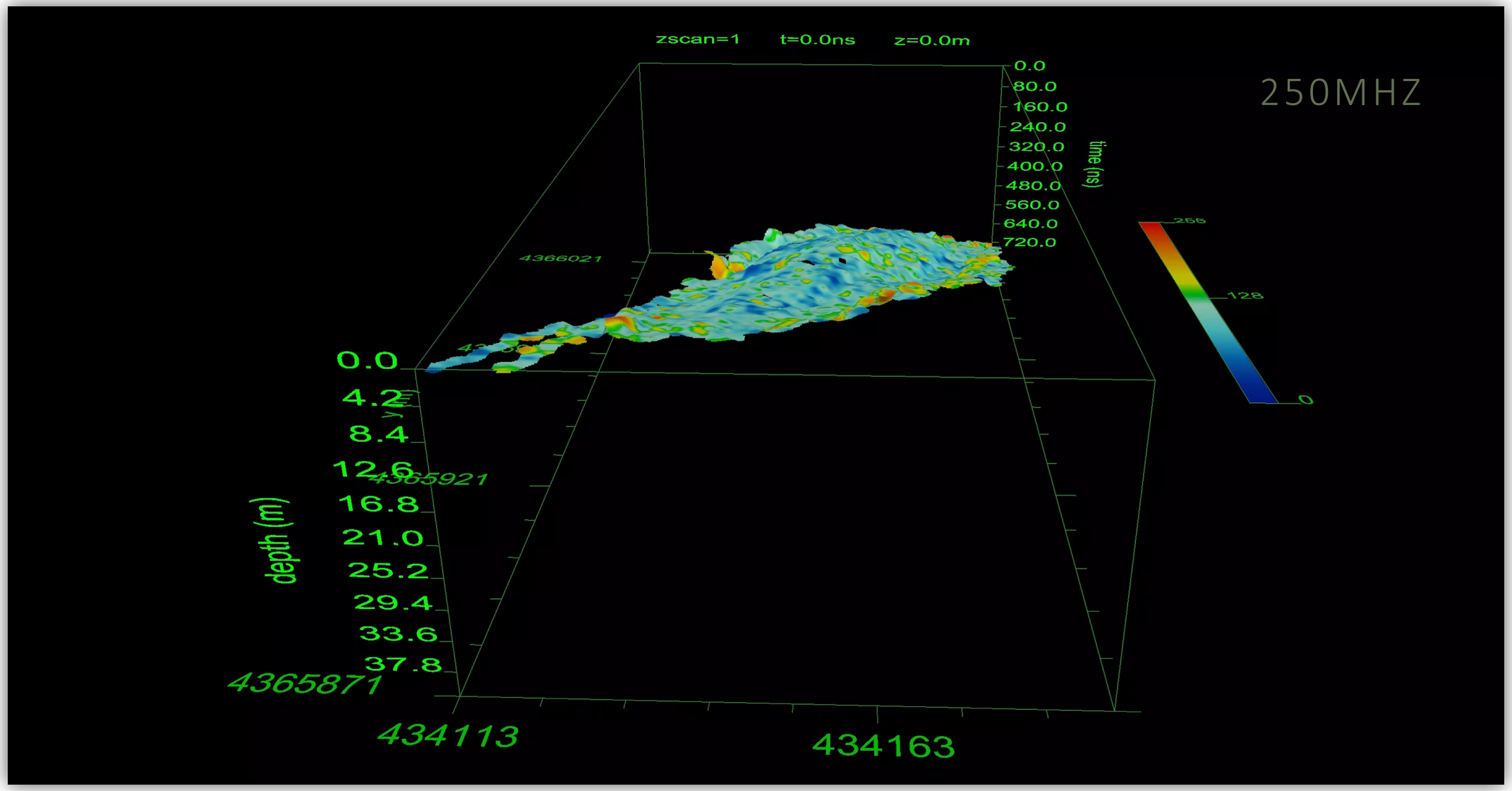
ANIMATION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4365921
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8.4
12.6
16.8
21.0
25.2
29.4
33.6
37.8
4365871
434113
434163

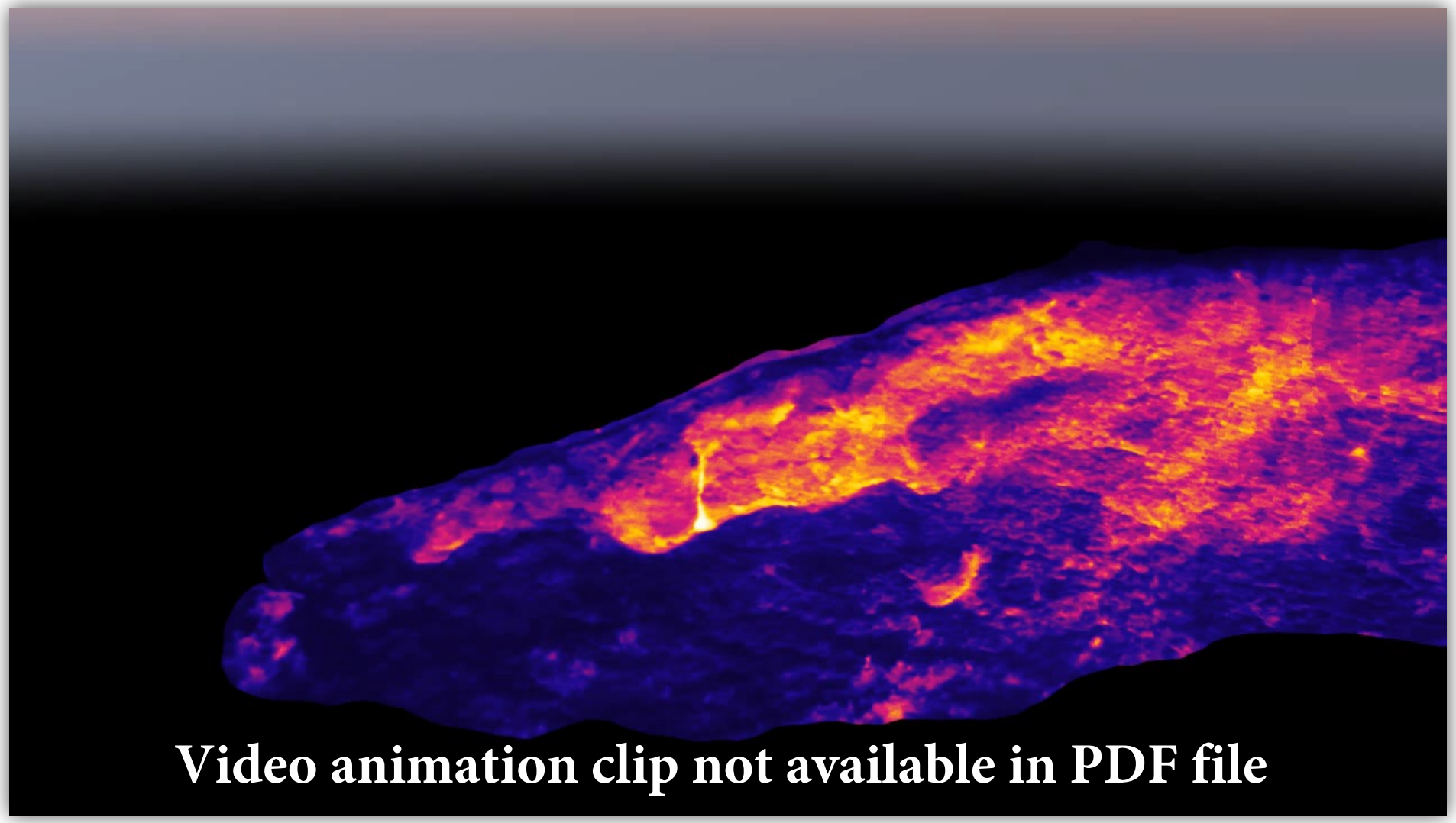
Thermography

Thermography

Using a 3-axis stabilization gimble provided by DSLR Pros and a FLIR thermal camera with 640 9hz resolution, the documentation team recorded emitted infrared energy from selected areas of the boat-shaped ridges at dawn along the wall faces of the boat formation. The arid soil conditions and the time of year were not ideal for producing conclusive results. We therefore recommend two additional sets of thermal readings be taken, one at dawn and one at dusk, in more ideal conditions (e.g. after the rainy season or in the Turkish spring).

ANIMATION

ANIMATION



Photogrammetry

Photogrammetry

Using a Nikon D7000 DSLR camera, this stone monument was documented with 80% or better overlapping images and digitally preserved with high-fidelity photogrammetry techniques. This 3D mesh model was processed and rendered in Pix4D software.

ANIMATION