Seeing the Unseen

Unlocking Occluded Ecosystems from Above

Oliver Bimber



DRONES IN REMOTE SENSING FOR SUSTAINABILITY

Key Applications & Environmental Impacts

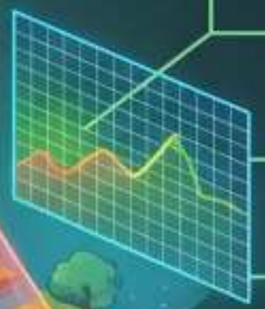
BIODIVERSITY & WILDLIFE

- Thermal Wildlife Counting
- Anti-Poaching & Patrols
- Forest Canopy Penetration (AOS)



FOREST ECOLOGY & CARBON

- Biomass & Carbon Estimation (LiDAR)
- Deforestation & Logging Tracking
- Tree Stress & Disease Detection (NDVI)



PRECISION AGRICULTURE

- Crop Health & Vigor Mapping
- Water Stress & Irrigation Planning
- Targeted Fertilizer & Resource Application

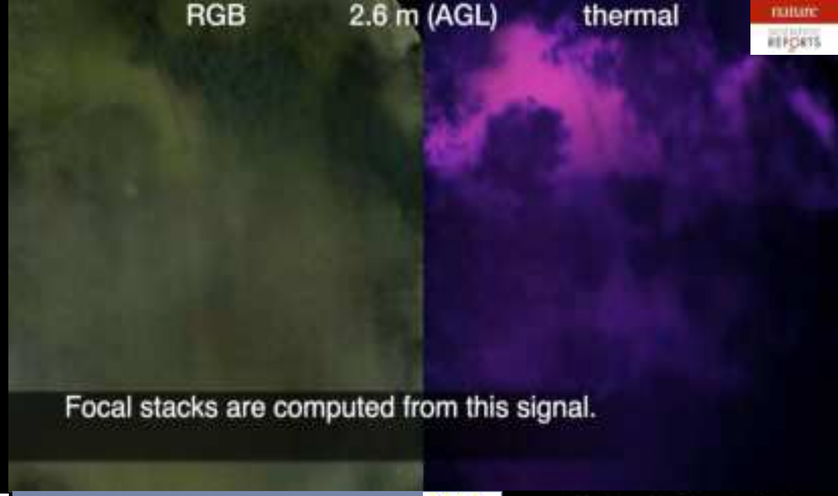
DISASTER & CLIMATE RESPONSE

- Wildfire Hotspot & Line Tracking
- Flood Plain & Erosion Mapping
- Post-Disaster Damage Assessment

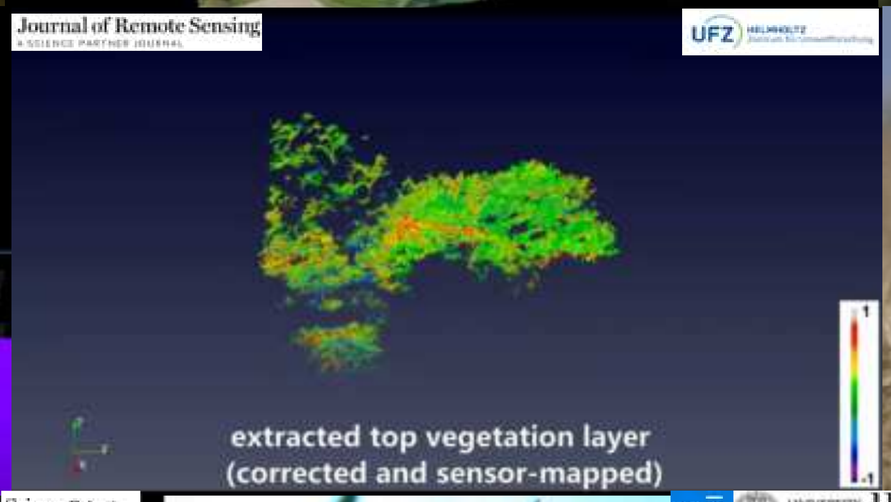
My Side of the Coin: Sustainability *with* CS



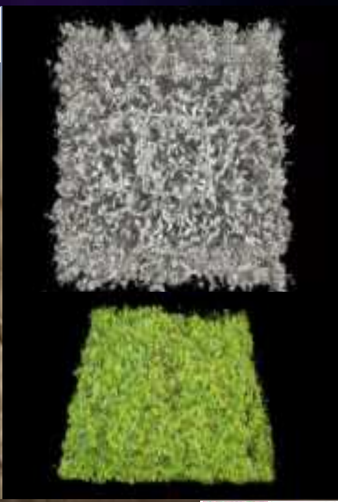



RGB
2.6 m (AGL)
thermal
Focal stacks are computed from this signal.



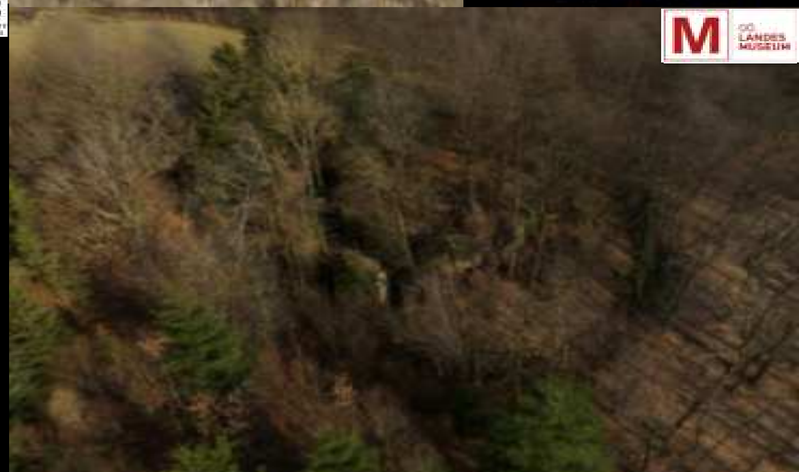

extracted top vegetation layer
(corrected and sensor-mapped)






P-GPS
RGB
RX OFF
F
5x

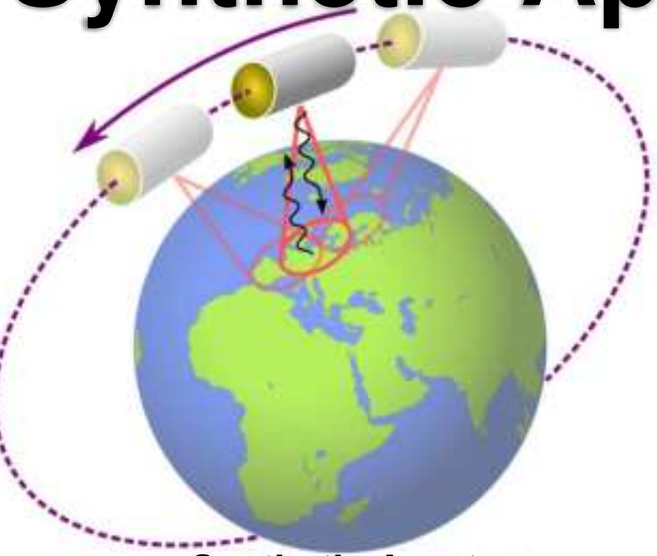

Peering Locust



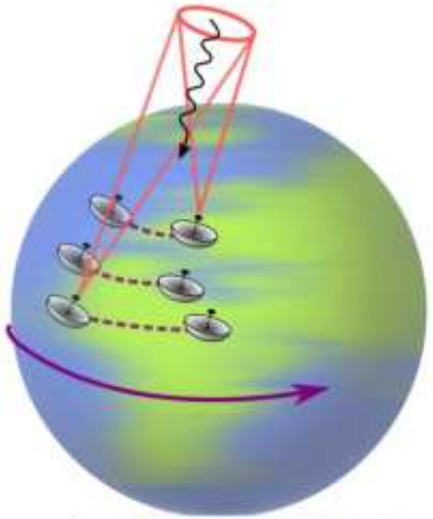
Airborne Optical Sectioning



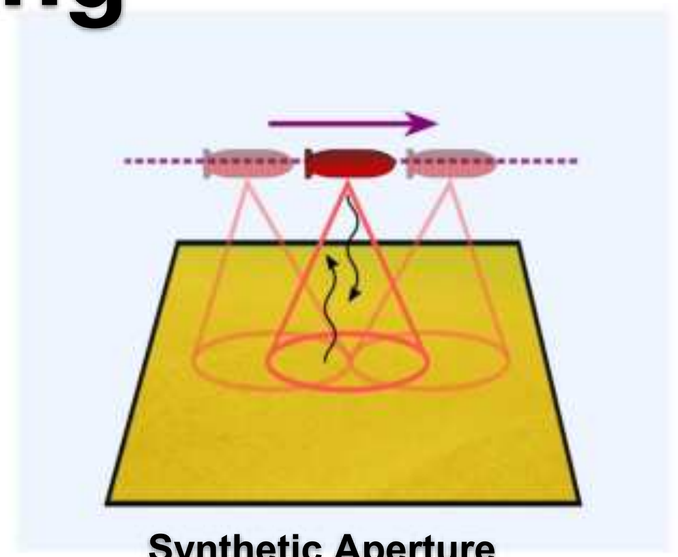
Synthetic Aperture Sensing



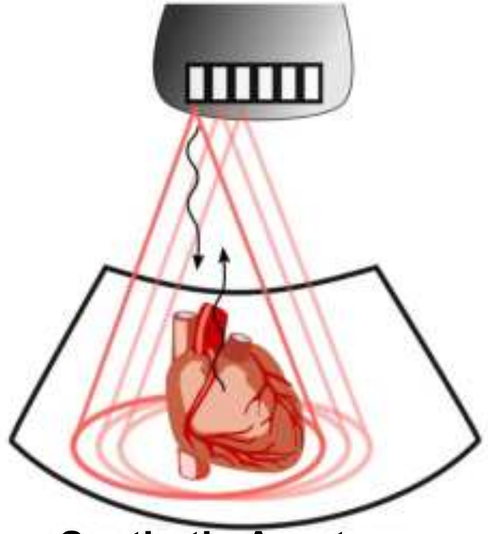
Synthetic Aperture
Radar (SAR)



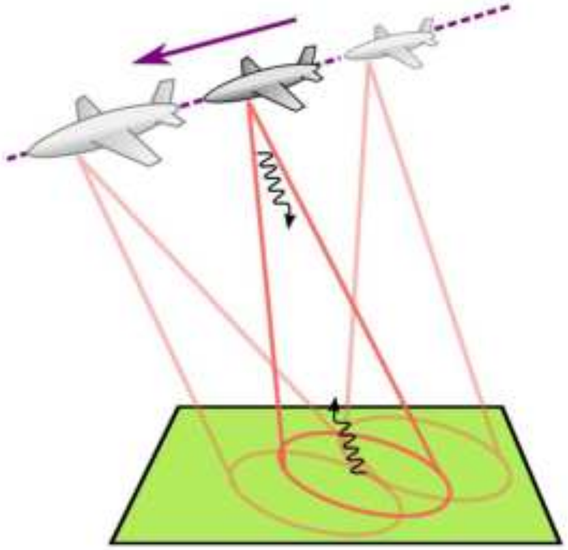
Synthetic Aperture
Radio Telescopes (SART)



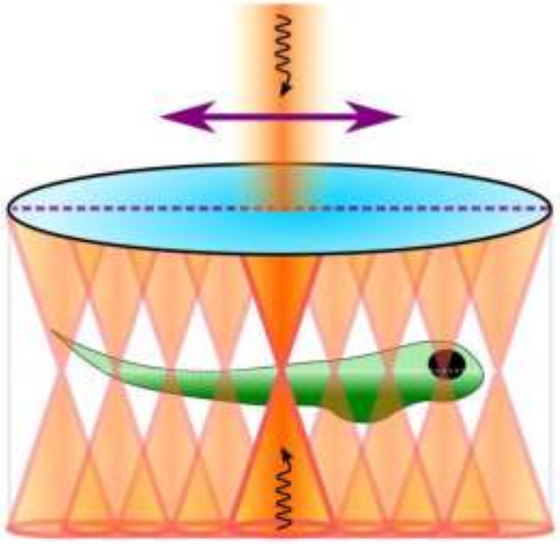
Synthetic Aperture
Sonar (SAS)



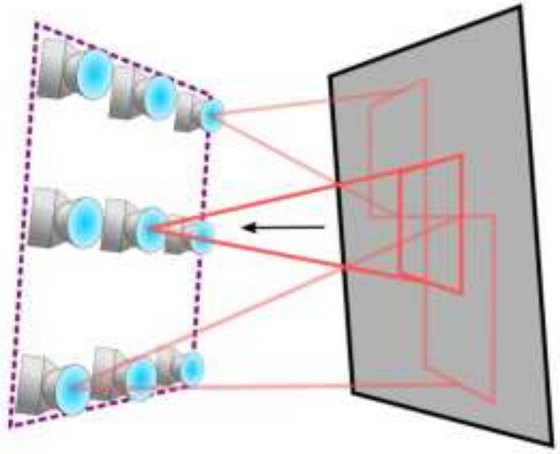
Synthetic Aperture
Ultrasound (SAU)



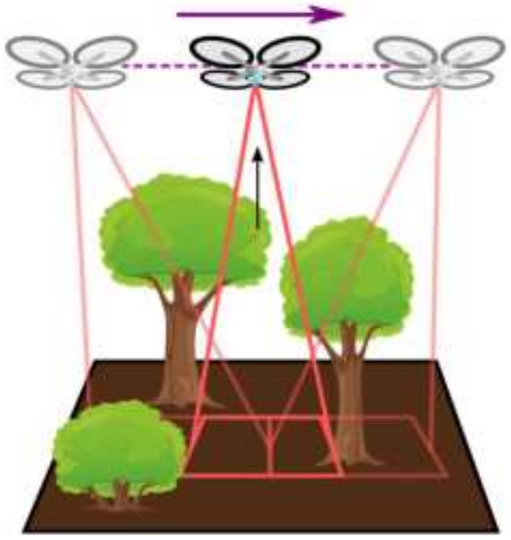
synthetic aperture LiDAR (SAL)
synthetic aperture
imaging laser (SAIL)



Interferometric Synthetic Aperture
Microscopy (ISAM)



Structured Light-Field
Imaging (SLFI)

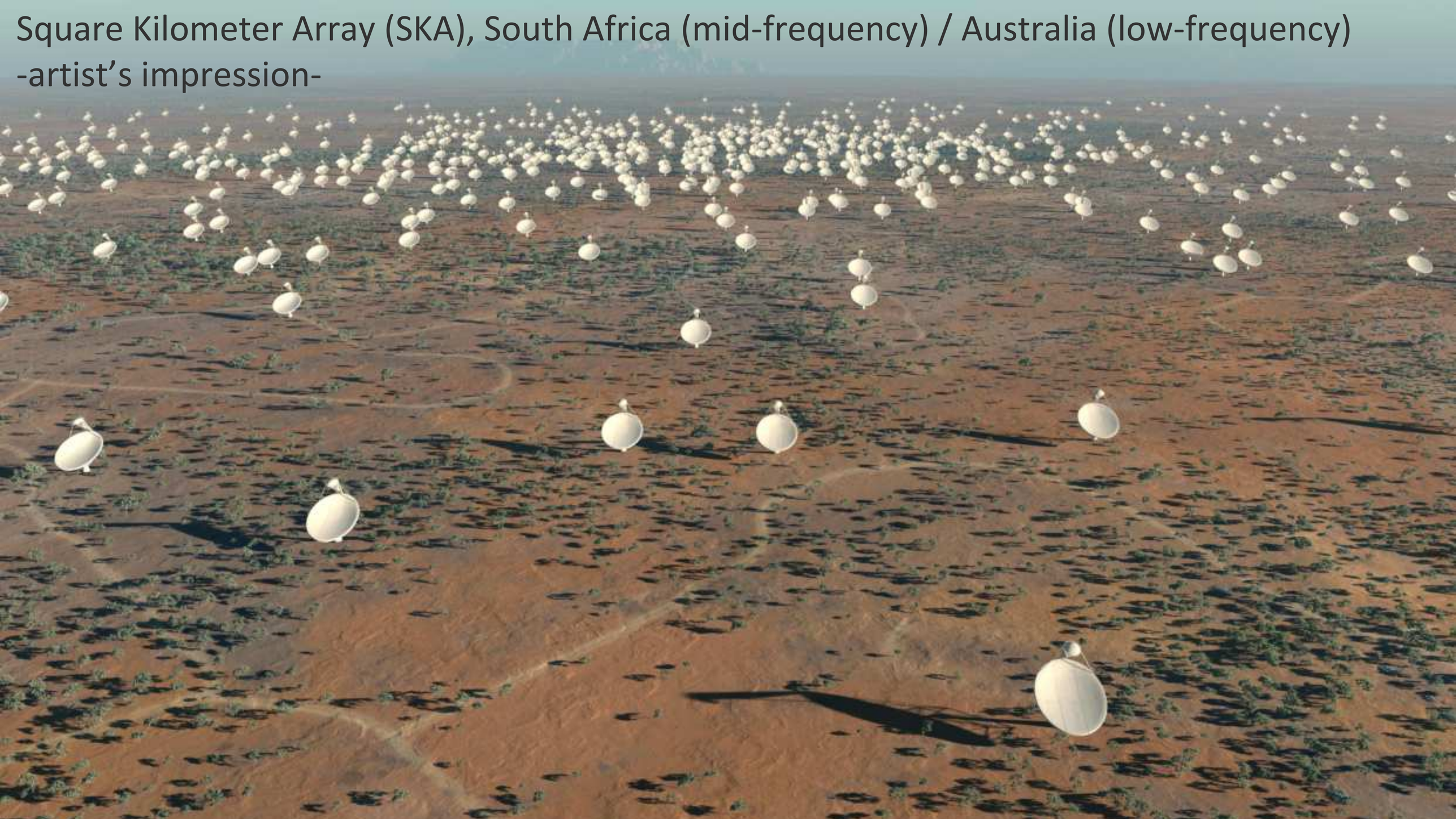


Airborne Optical Sectioning

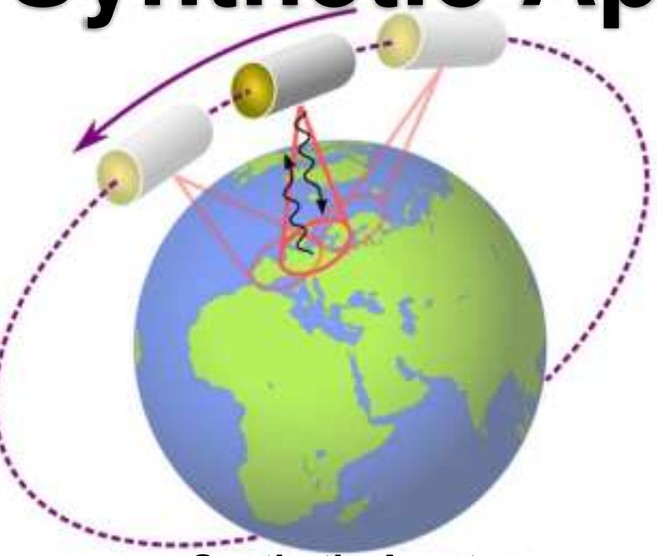
Five-Hundred-Meter Aperture Spherical Radio Telescope (FAST), China



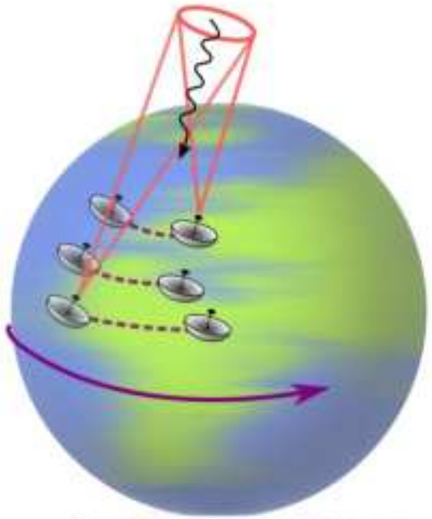
Square Kilometer Array (SKA), South Africa (mid-frequency) / Australia (low-frequency)
-artist's impression-



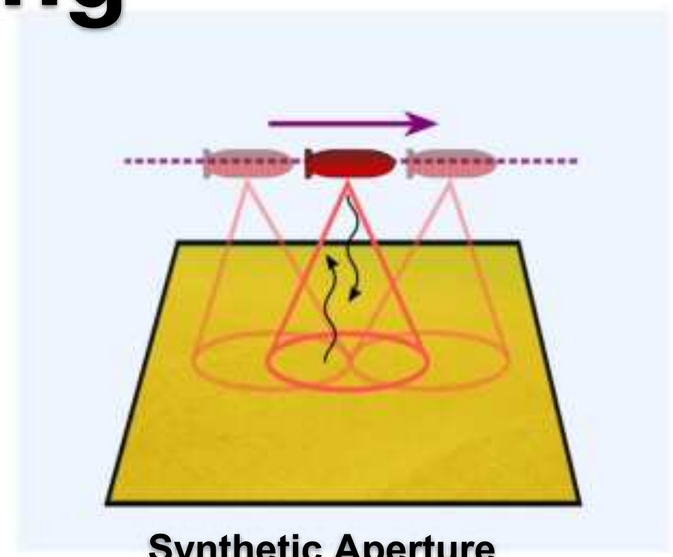
Synthetic Aperture Sensing



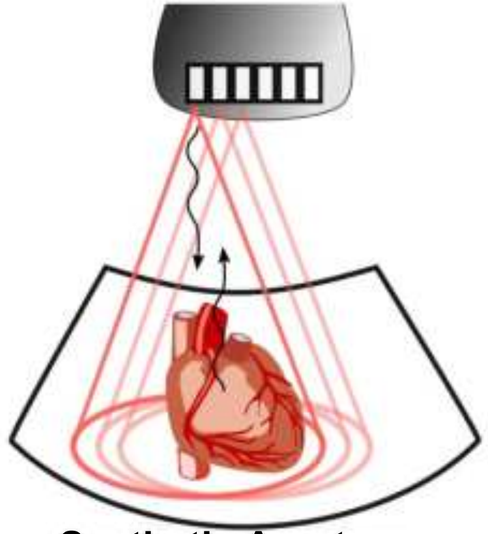
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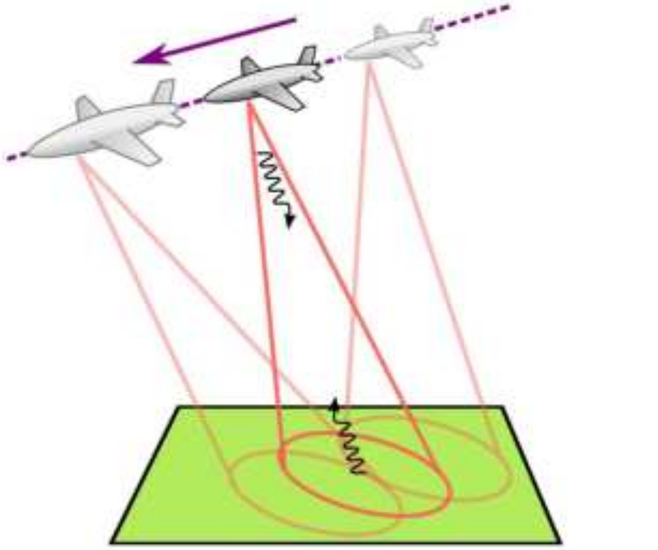
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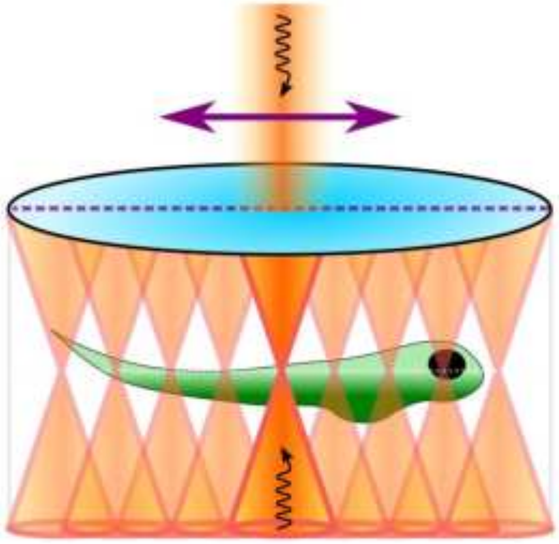
Synthetic Aperture
Sonar (SAS)



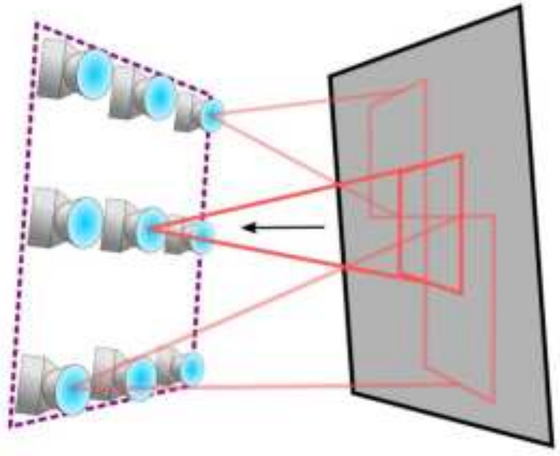
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Ultrasound (SAU)



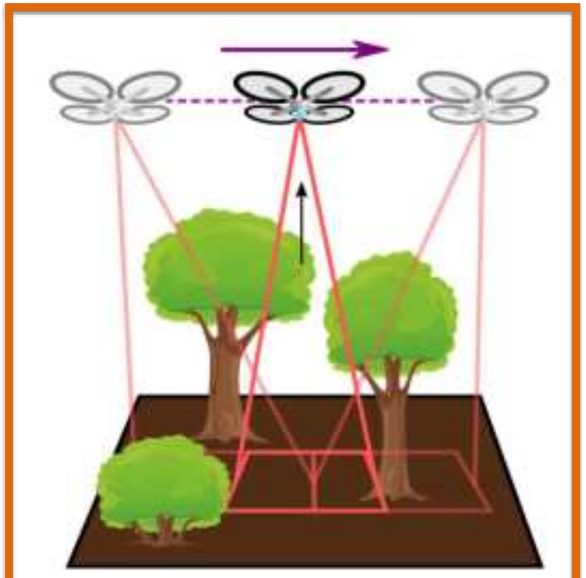
synthetic aperture LiDAR (SAL)
synthetic aperture
imaging laser (SAIL)



Interferometric Synthetic Aperture
Microscopy (ISAM)

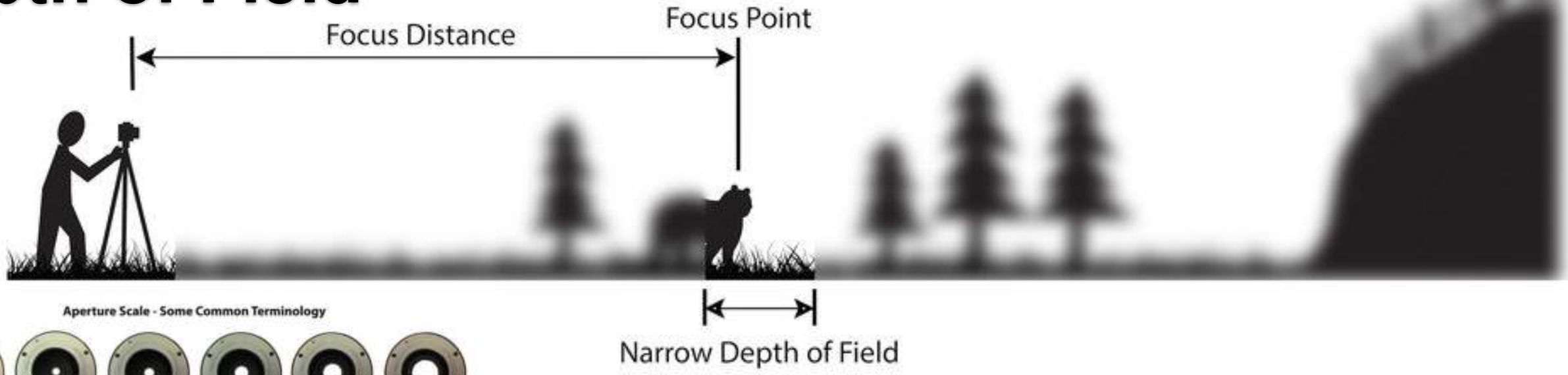


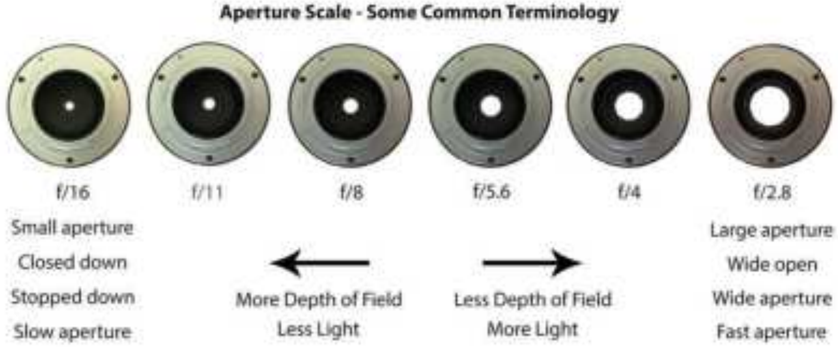
Structured Light-Field
Imaging (SLFI)



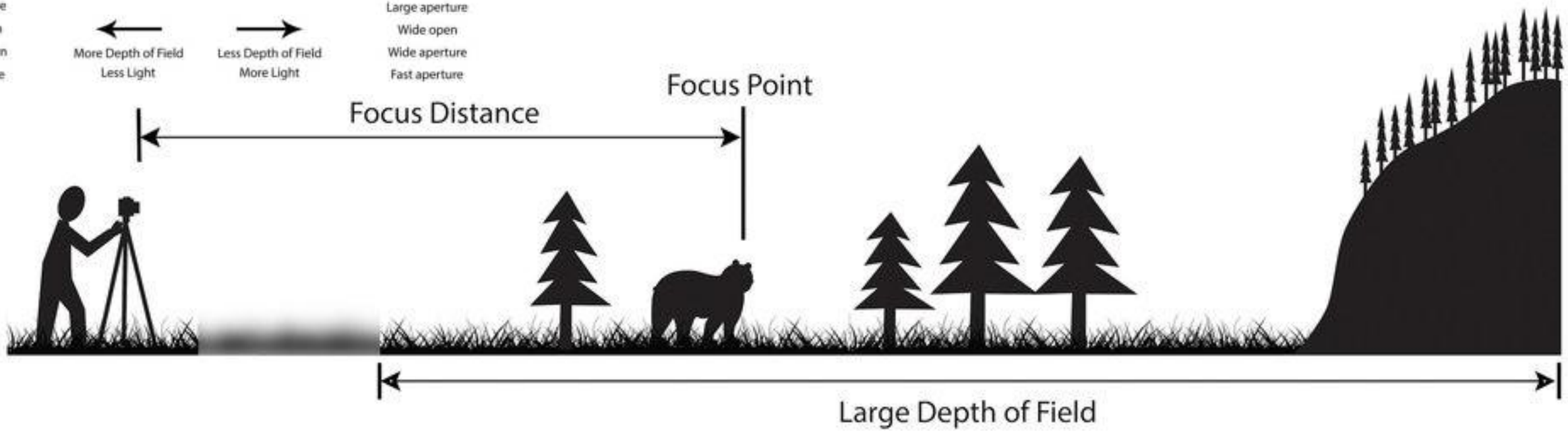
Airborne Optical Sectioning

Depth of Field





We need an aperture of several (10-100) meters!



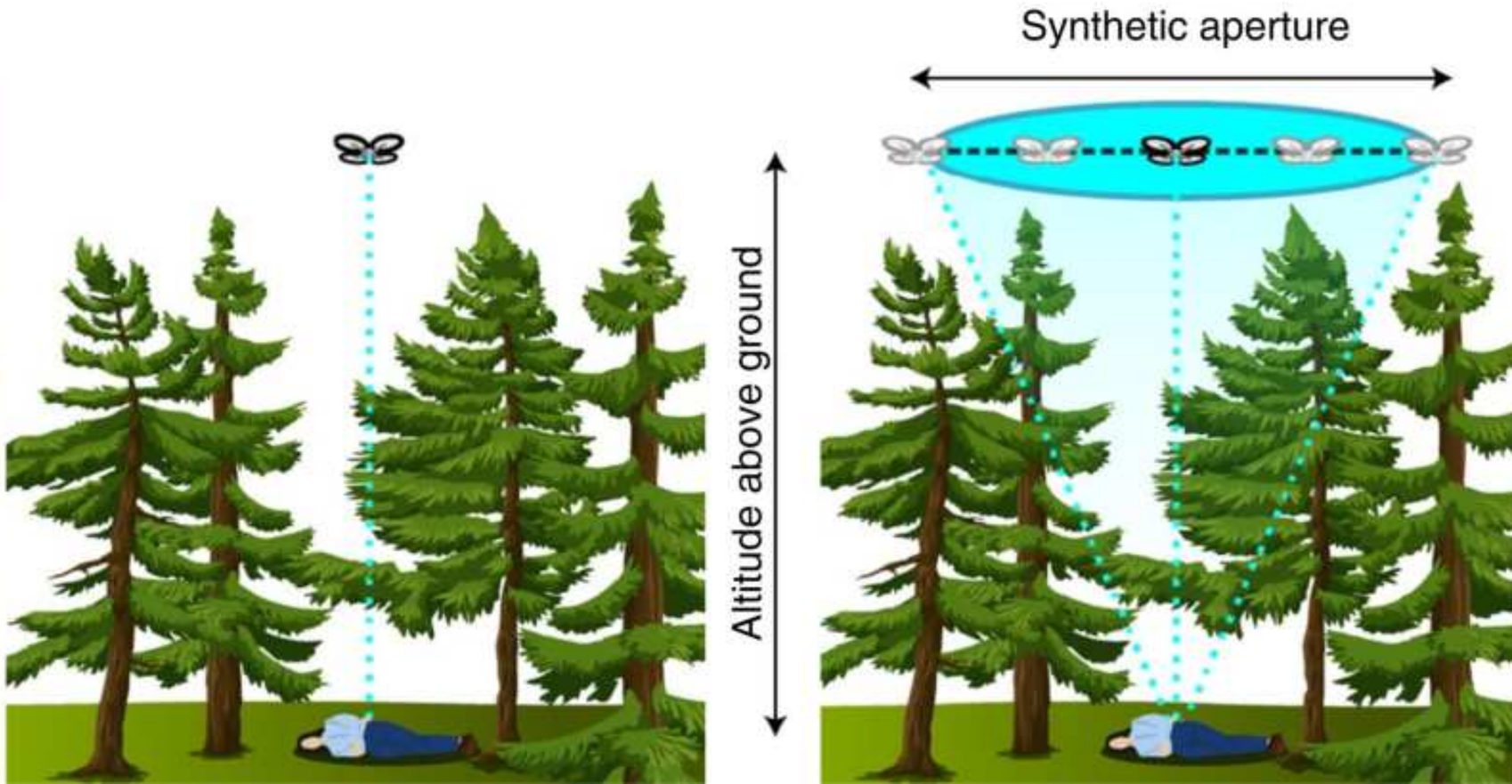
Vera C. Rubin Observatory, Chile




AOS


AOS




Synthetic aperture
Altitude above ground



nature
SCIENTIFIC REPORTS



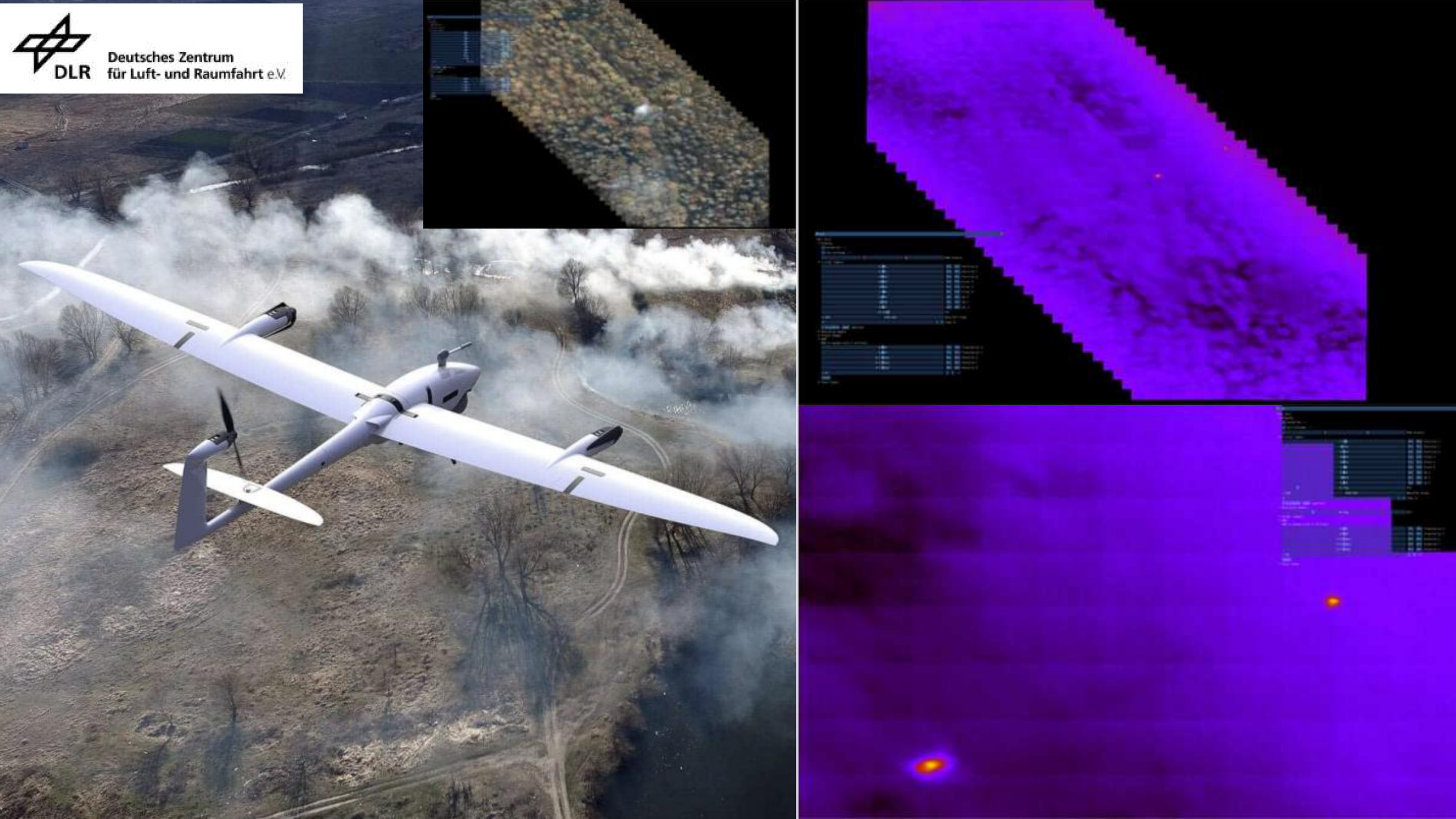
nature
SCIENTIFIC REPORTS

LANDES
FEUERWEHR
KOMMANDO OÖ





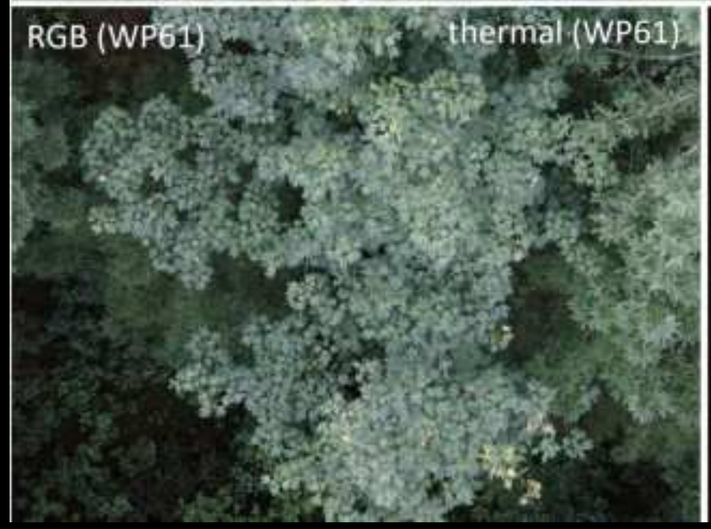
Rax, 2021

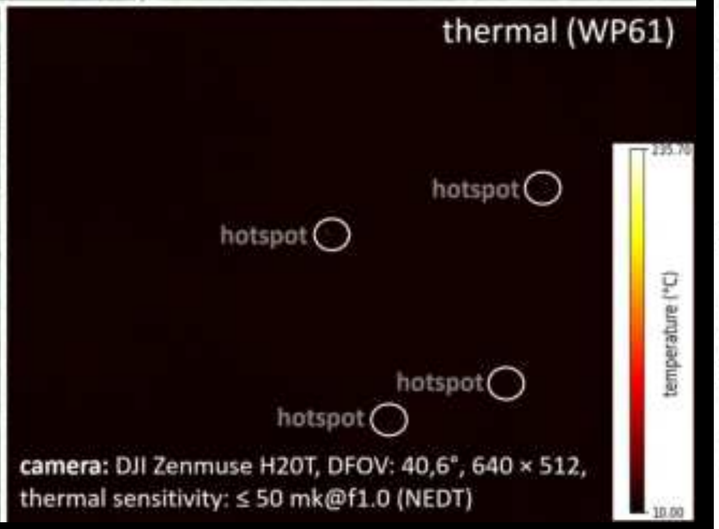

DLR
Deutsches Zentrum
für Luft- und Raumfahrt e.V.

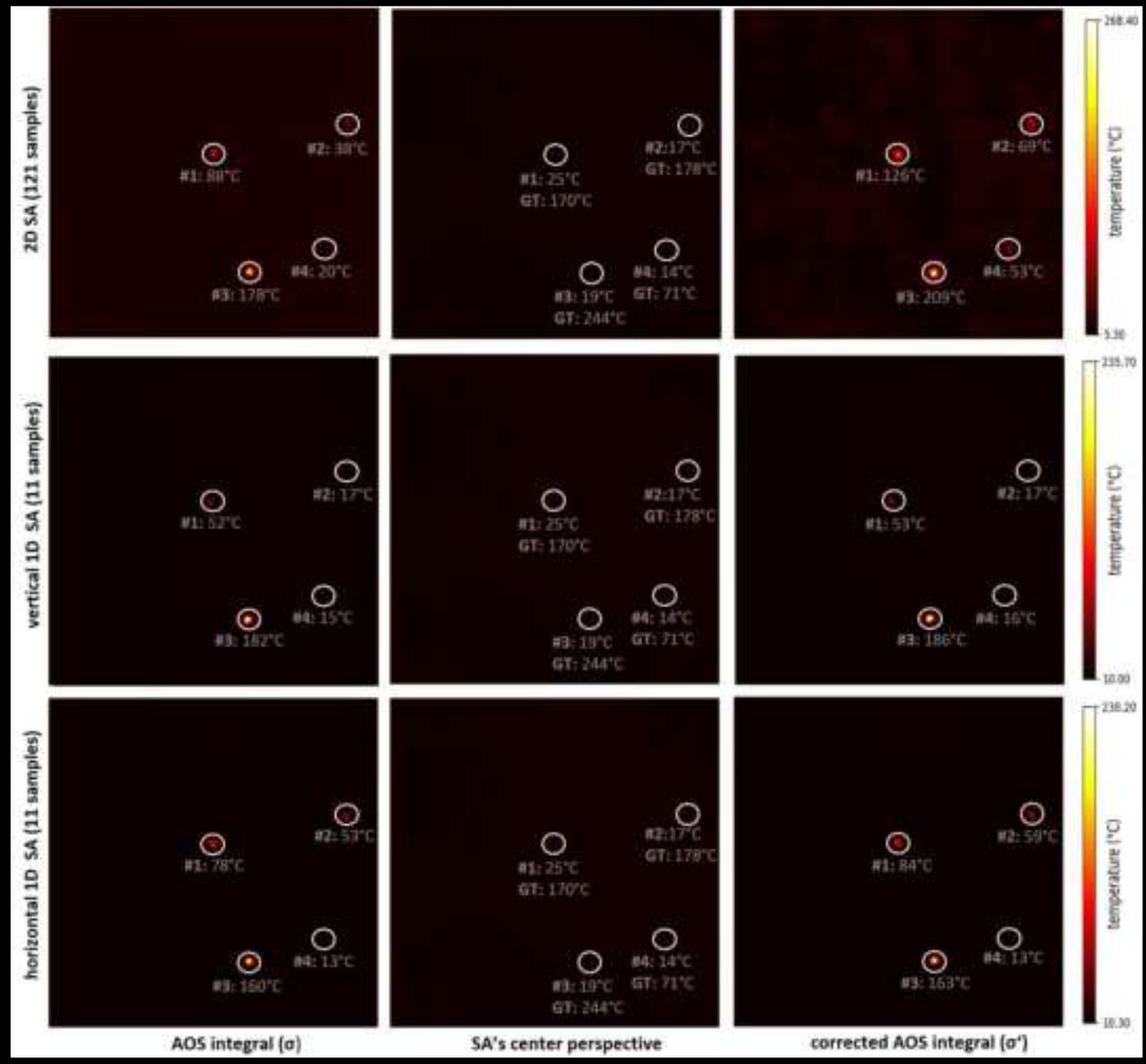
nature communications ai & computing

LANDES FEUERWEHR KOMMANDO OÖ





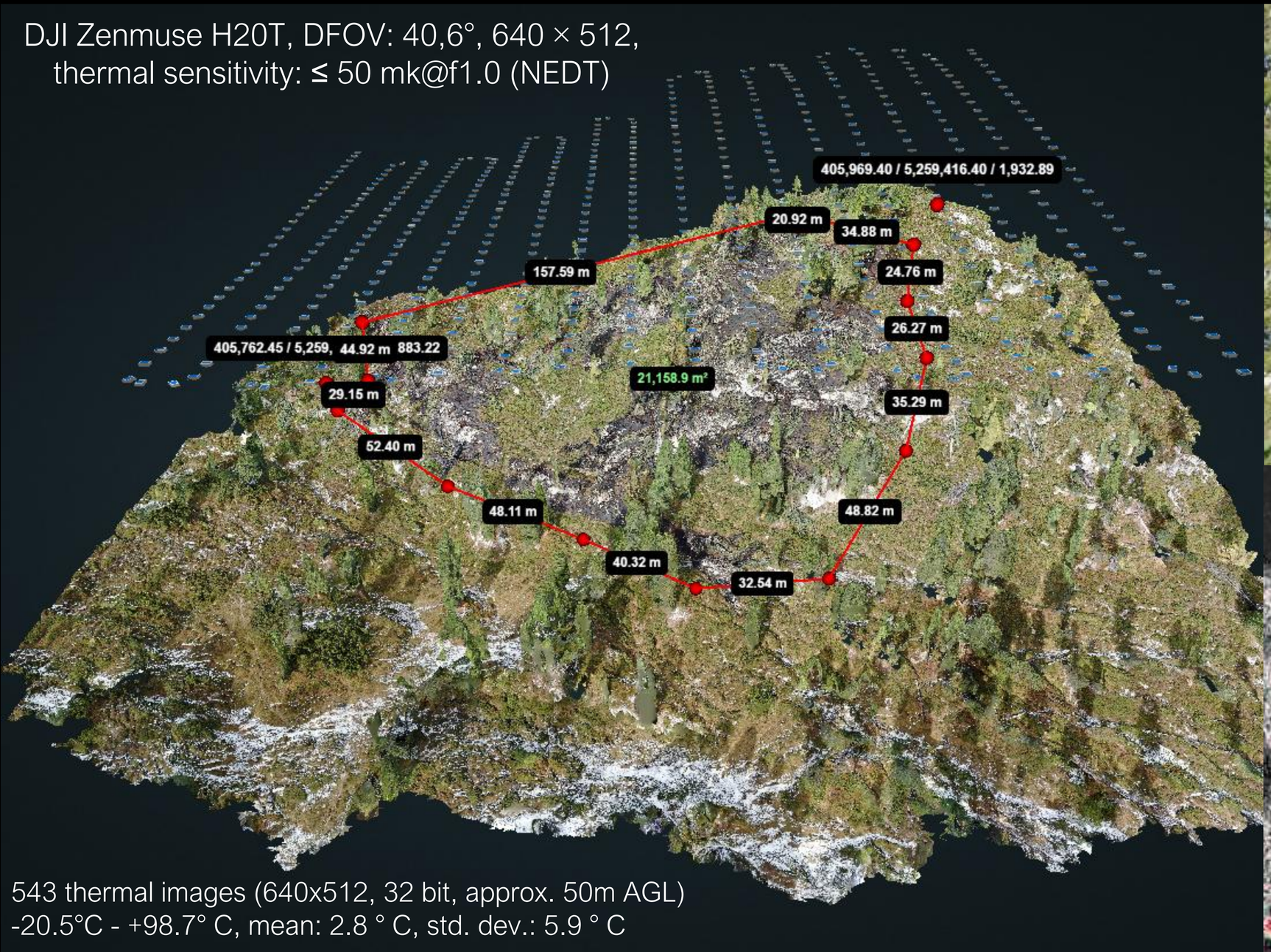




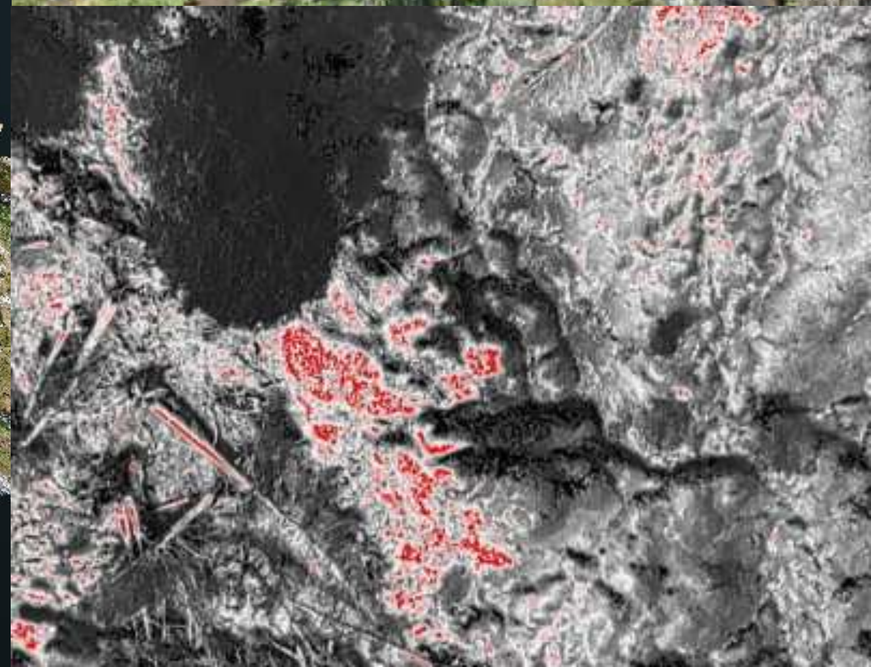
nature communications ai & computing

LANDES FEUERWEHR KOMMANDO OÖ

DJI Zenmuse H20T, DFOV: 40,6°, 640 × 512,
thermal sensitivity: ≤ 50 mk@f1.0 (NEDT)





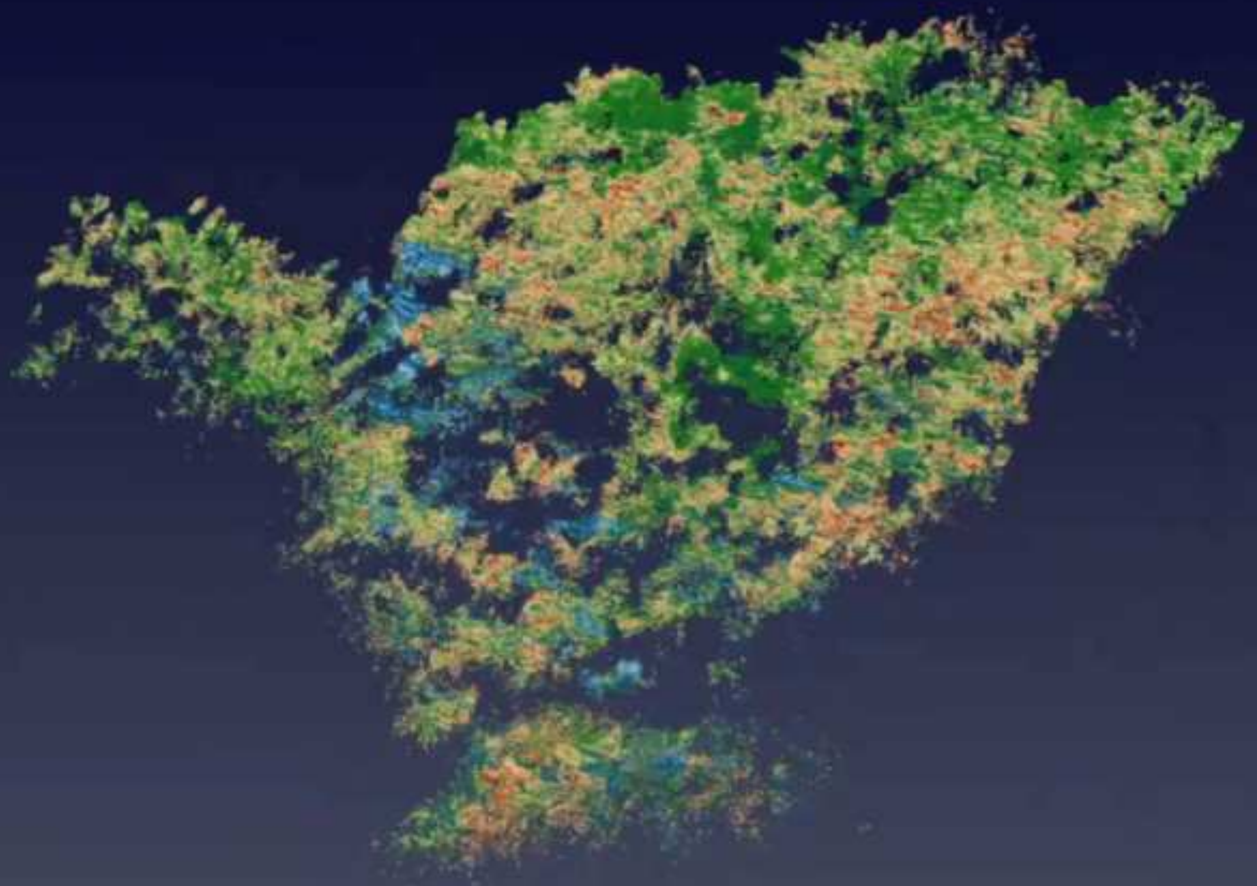


543 thermal images (640x512, 32 bit, approx. 50m AGL)
-20.5°C - +98.7° C, mean: 2.8 ° C, std. dev.: 5.9 ° C



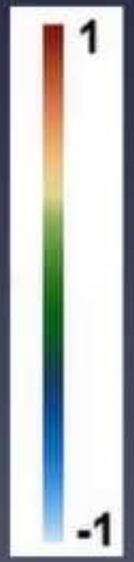
Journal of Remote Sensing
A SCIENCE PARTNER JOURNAL

UFZ HELMHOLTZ Zentrum für Umweltforschung



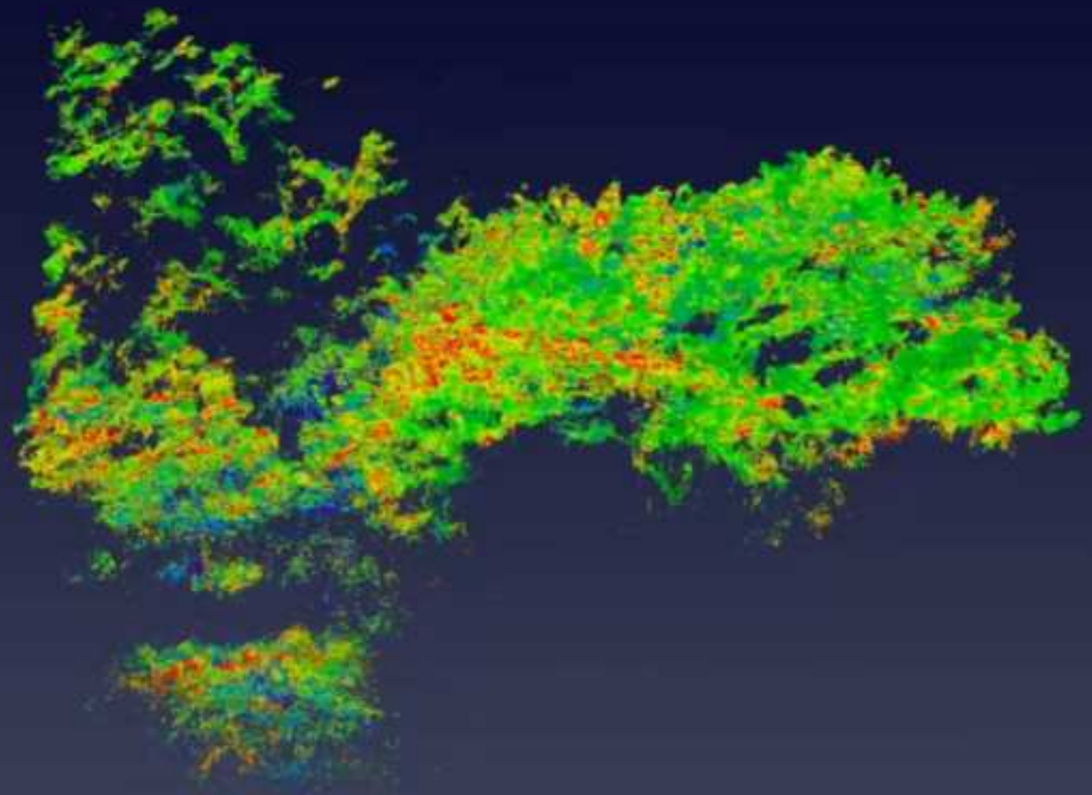


extracted top vegetation layer
(corrected and sensor-mapped)



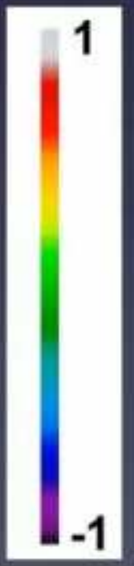
Journal of Remote Sensing
A SCIENCE PARTNER JOURNAL

UFZ HELMHOLTZ Zentrum für Umweltforschung



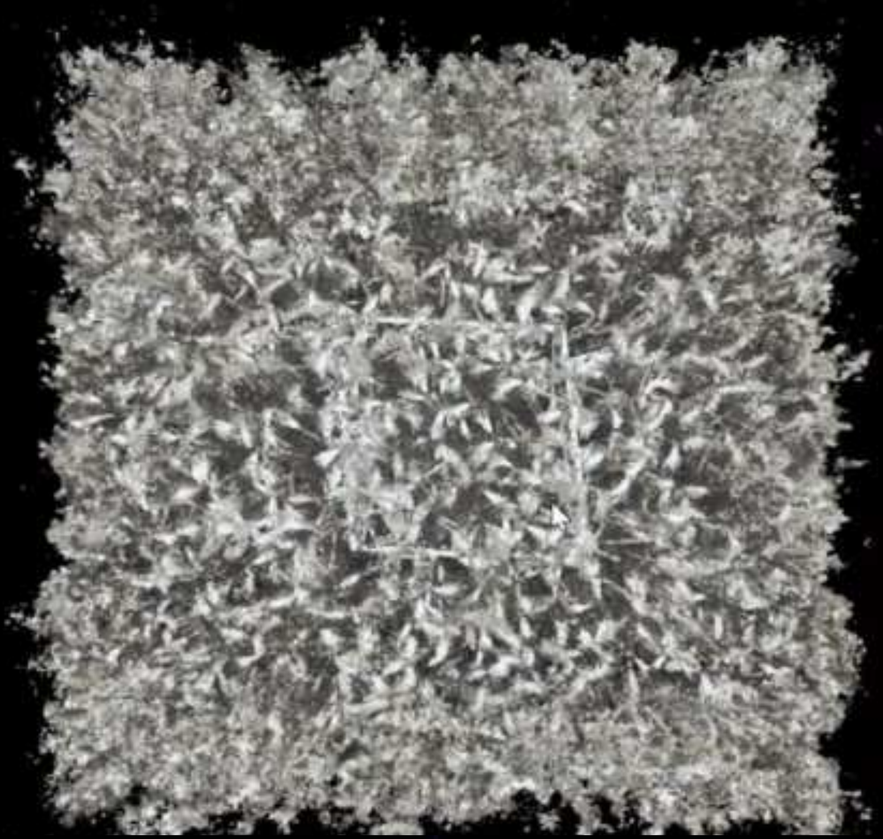


extracted top vegetation layer
(corrected and sensor-mapped)



HV
ÖSTERREICHISCHE
HAGELVERSICHERUNG







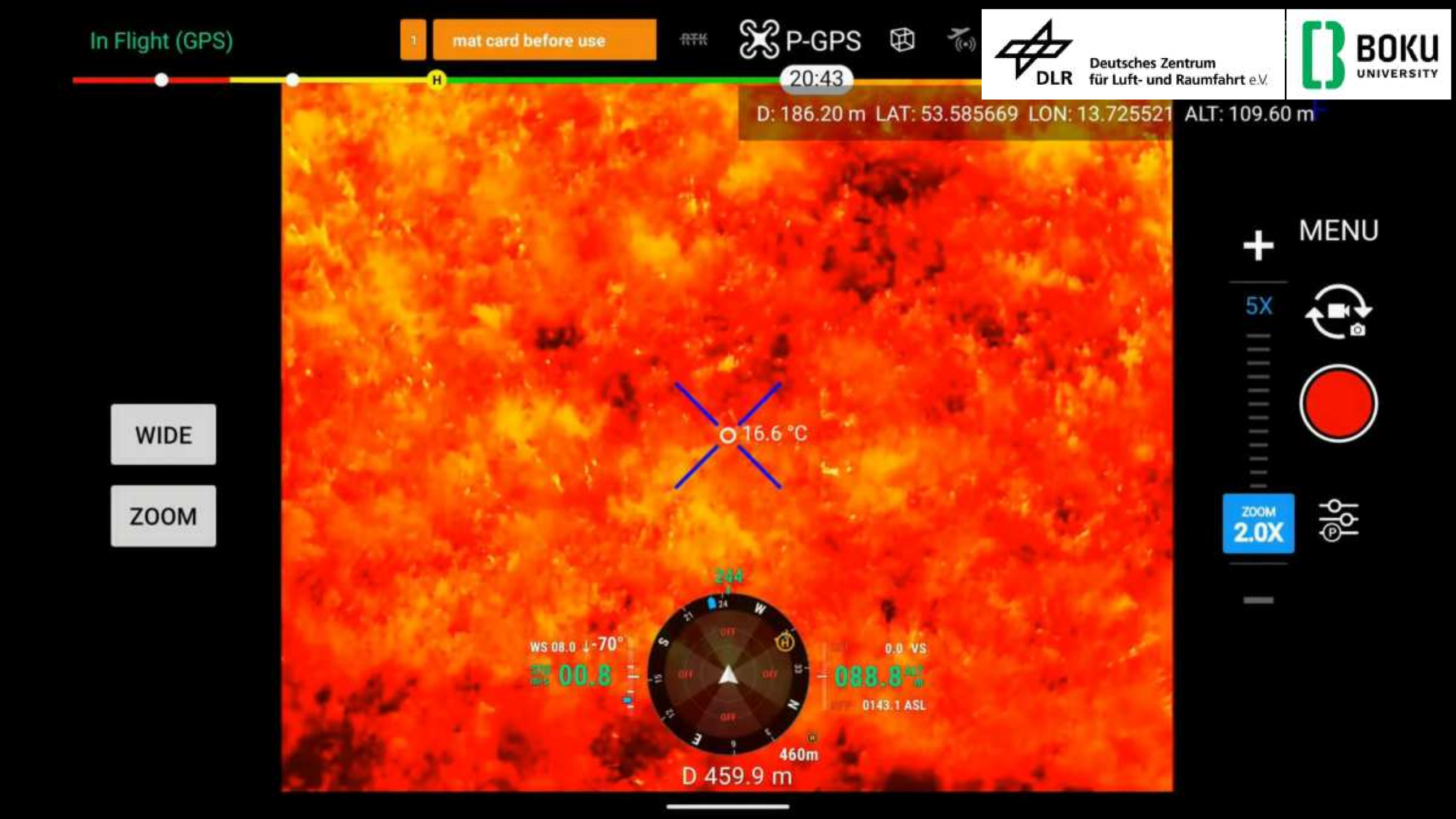


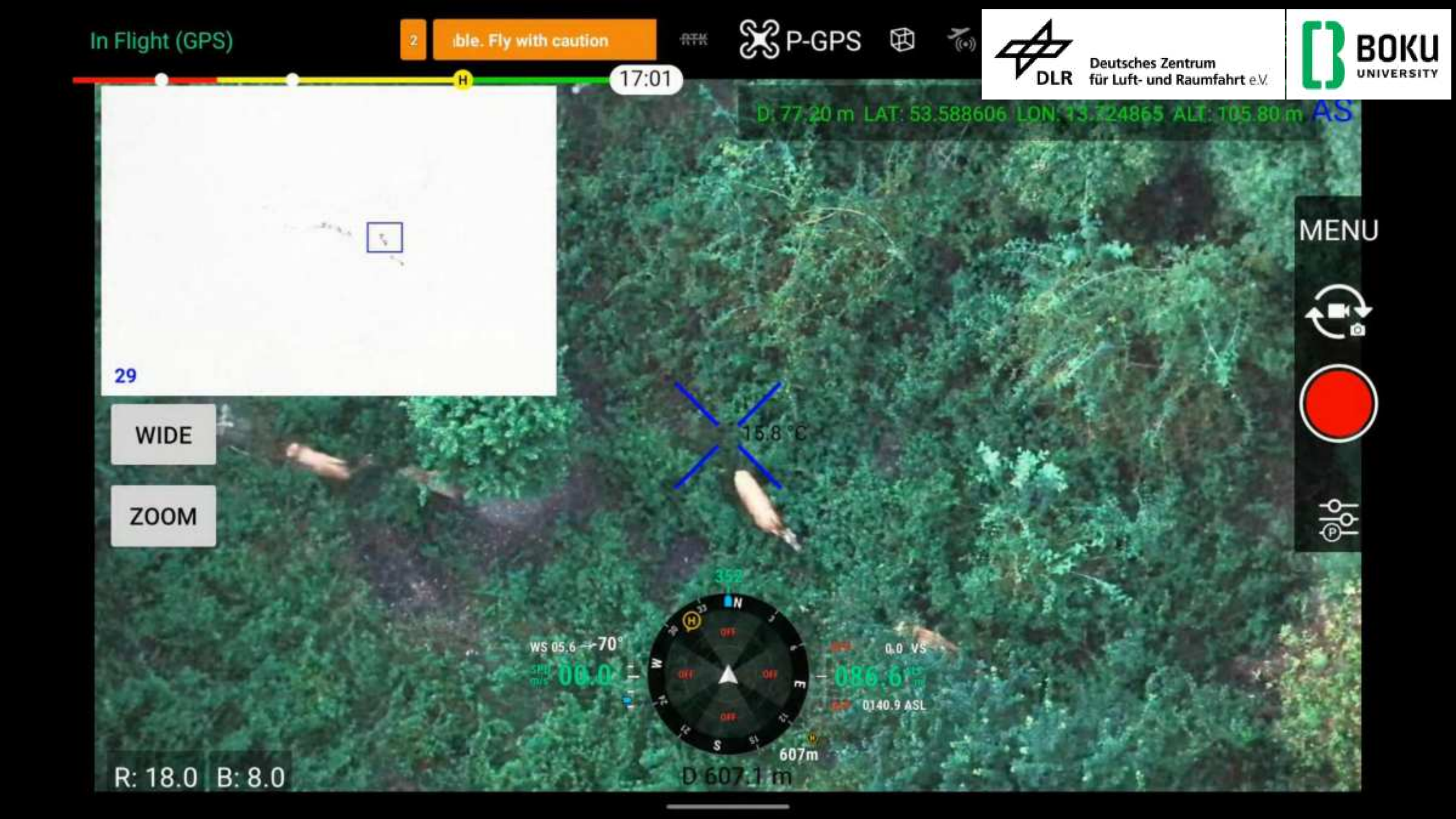


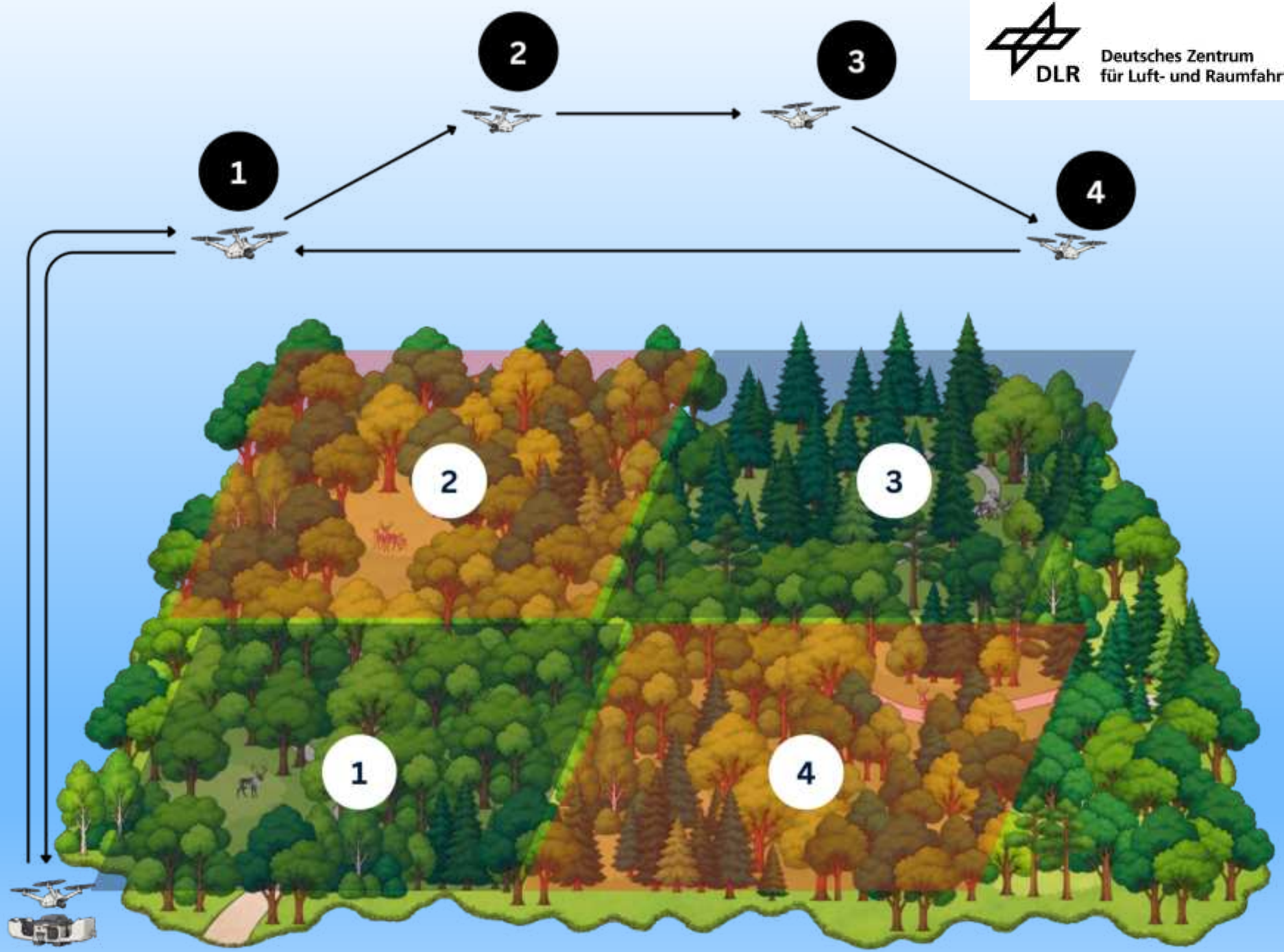


Natuur Digitaal (Marc Plomp), Stichting Natuurbeelden


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BOKU
UNIVERSITY


In Flight (GPS)
1
mat card before use
P-GPS
20:43
DLR
Deutsches Zentrum
für Luft- und Raumfahrt e.V.
BOKU
UNIVERSITY
D: 186.20 m LAT: 53.585669 LON: 13.725521 ALT: 109.60 m
MENU
5X
WIDE
ZOOM
ZOOM
2.0X
16.6 °C
244
WS 08.0 ↓-70°
00.8
0.0 VS
088.8
0143.1 ASL
460m
D 459.9 m


In Flight (GPS)
2
ible. Fly with caution
P-GPS
17:01
DLR
Deutsches Zentrum
für Luft- und Raumfahrt e.V.
BOKU
UNIVERSITY
D: 77.20 m LAT: 53.588606 LON: 13.224865 ALT: 105.80 m
AS
MENU
29
WIDE
ZOOM
15.8 °C
352
WS 05.6
70°
00.0
086.6
0.0 VS
0140.9 ASL
607m
D 607.1 m
R: 18.0
B: 8.0


1
2
3
4
1
2
3
4

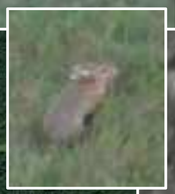
DEUTSCHE
WILDTIER
STIFTUNG







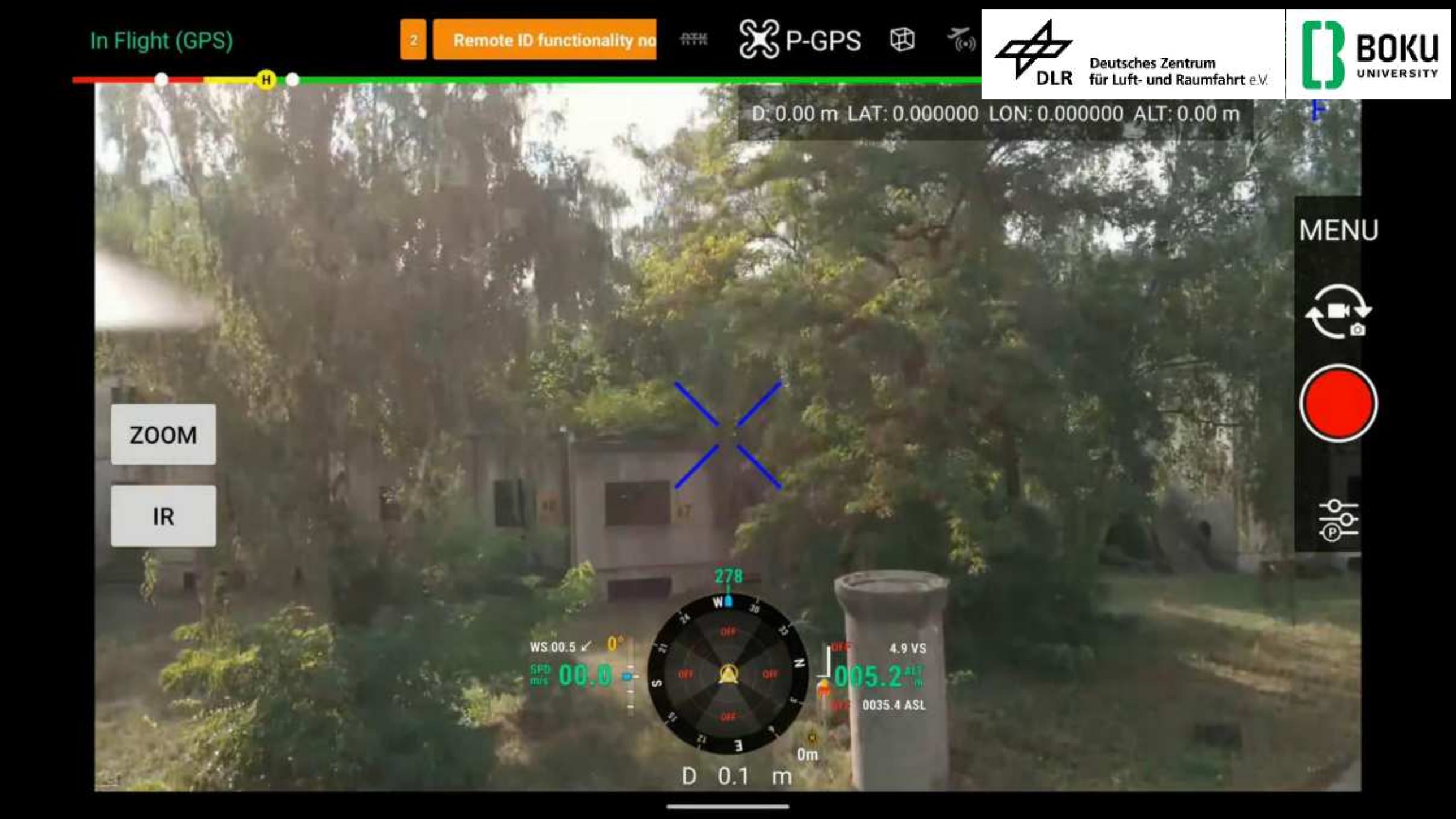











In Flight (GPS)
2
Remote ID functionality no
P-GPS
DLR
Deutsches Zentrum
für Luft- und Raumfahrt e.V.
BOKU
UNIVERSITY
D: 0.00 m LAT: 0.000000 LON: 0.000000 ALT: 0.00 m
MENU
ZOOM
IR
278
WS 00.5
0°
SPD
m/s
00.0
4.9 VS
005.2
ALT
m
0035.4 ASL
0m
D 0.1 m

Sumatran Rhino Sanctuary
Way Kambas National Park
May 1st – May 15th, 2026



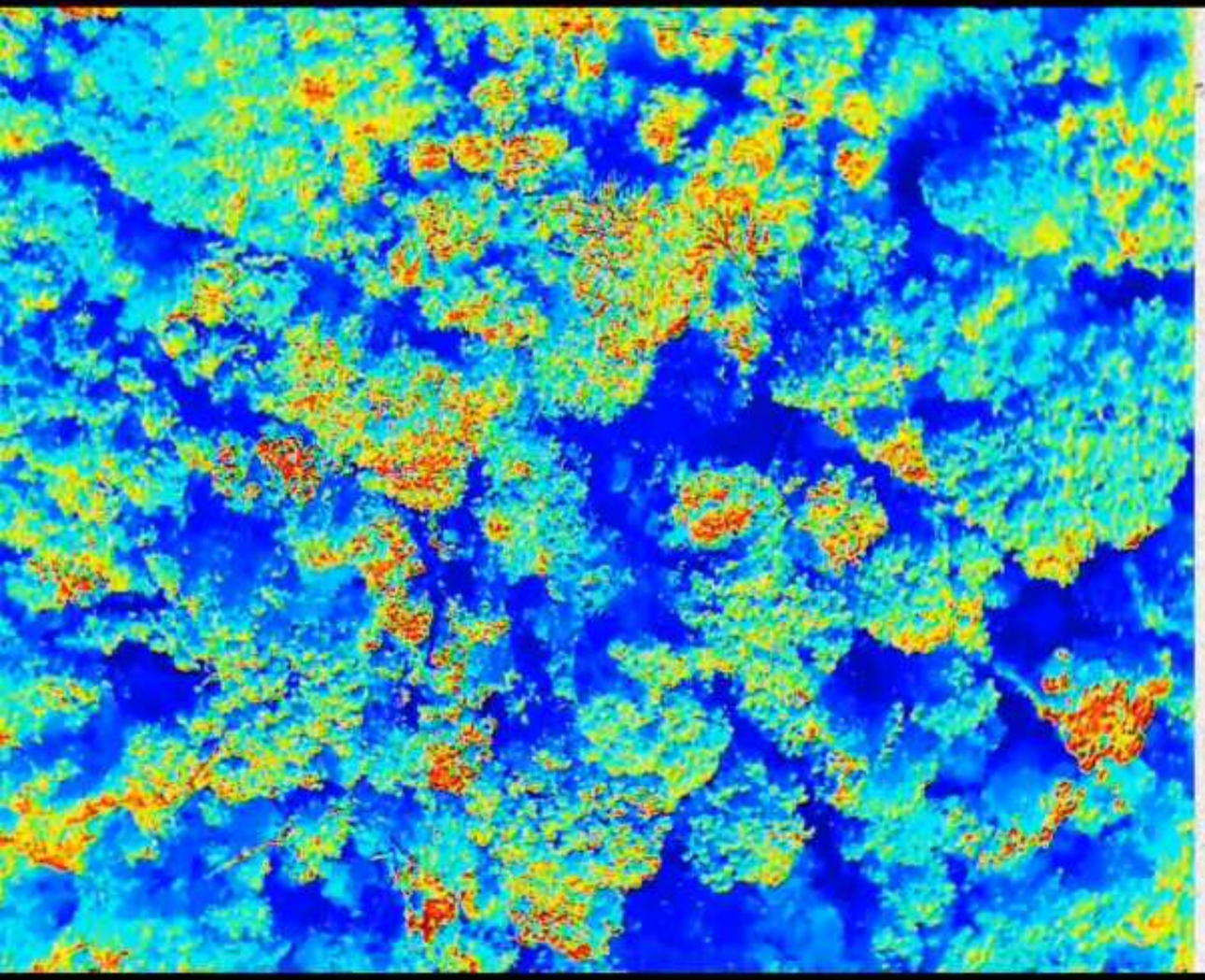

YABI


YABI


YABI

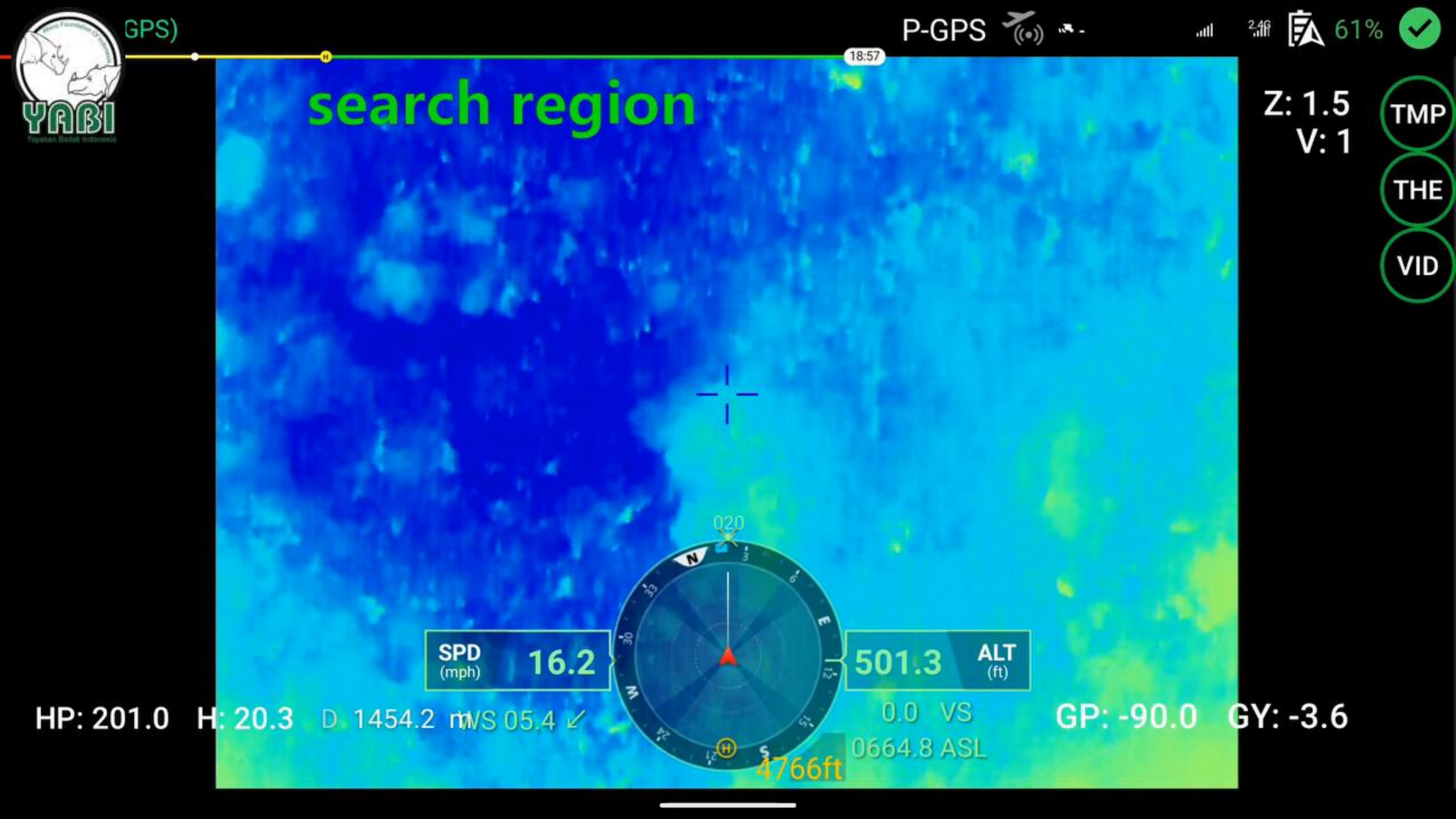

Suaka
Rhino
Sumatera
Sumatran
Rhino
Sanctuary
YABI - TNWK

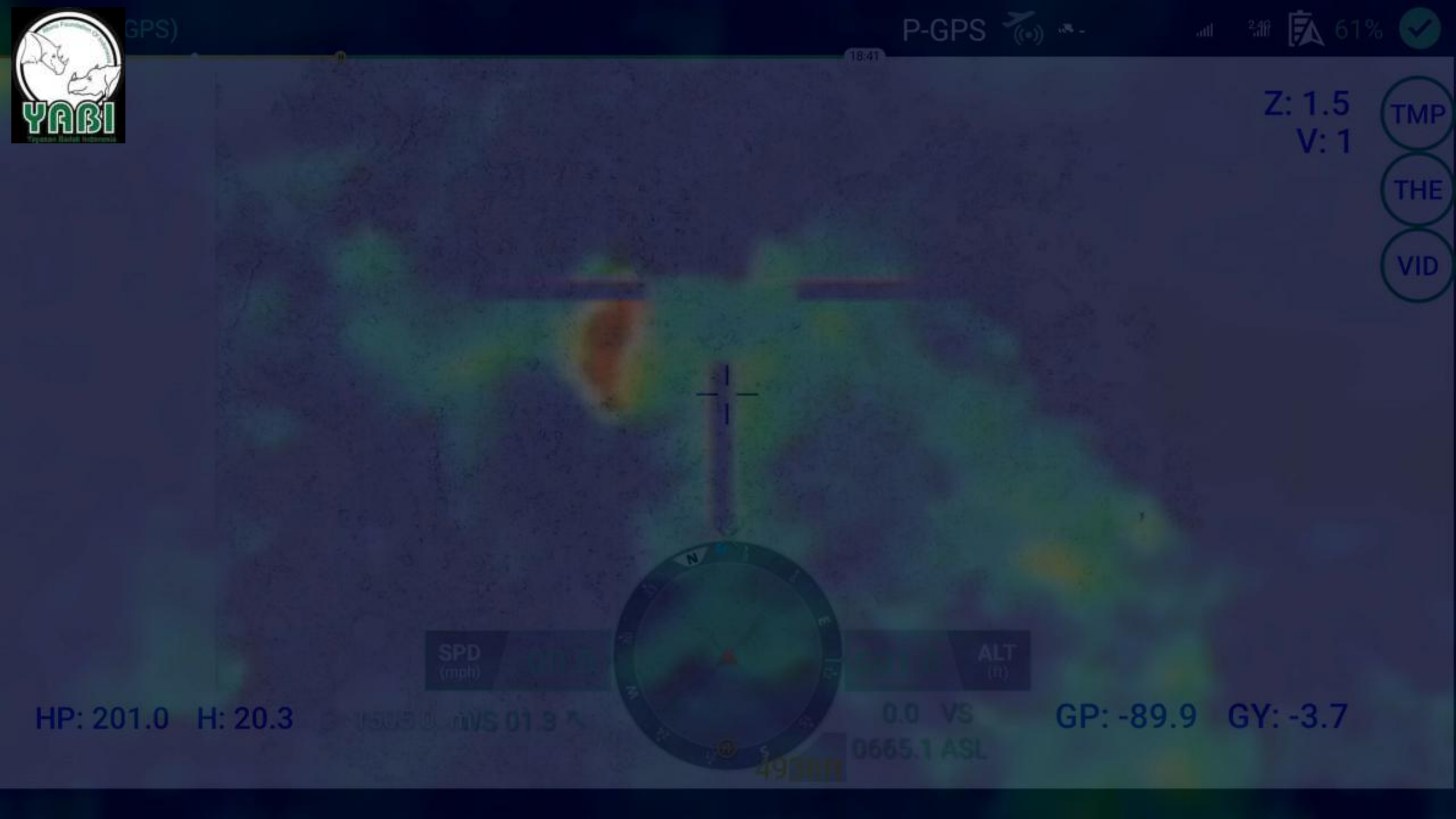









GPS)
P-GPS
61%
18:57
search region
Z: 1.5
V: 1
TMP
THE
VID
020
SPD
(mph)
16.2
501.3
ALT
(ft)
0.0 VS
0664.8 ASL
4766ft
HP: 201.0
H: 20.3
D 1454.2 m
WS 05.4
GP: -90.0
GY: -3.6


GPS)
P-GPS
61%
Z: 1.5
V: 1
TMP
THE
VID
SPD
(mph)
ALT
(m)
HP: 201.0
H: 20.3
0.0 VS
GP: -89.9
GY: -3.7
0665.1 ASL


YABI


YABI


YABI


YABI
Yayasan Badak Indonesia


YABI


YABI




YABI

YABI
Yayasan Badak Indonesia

ORTA

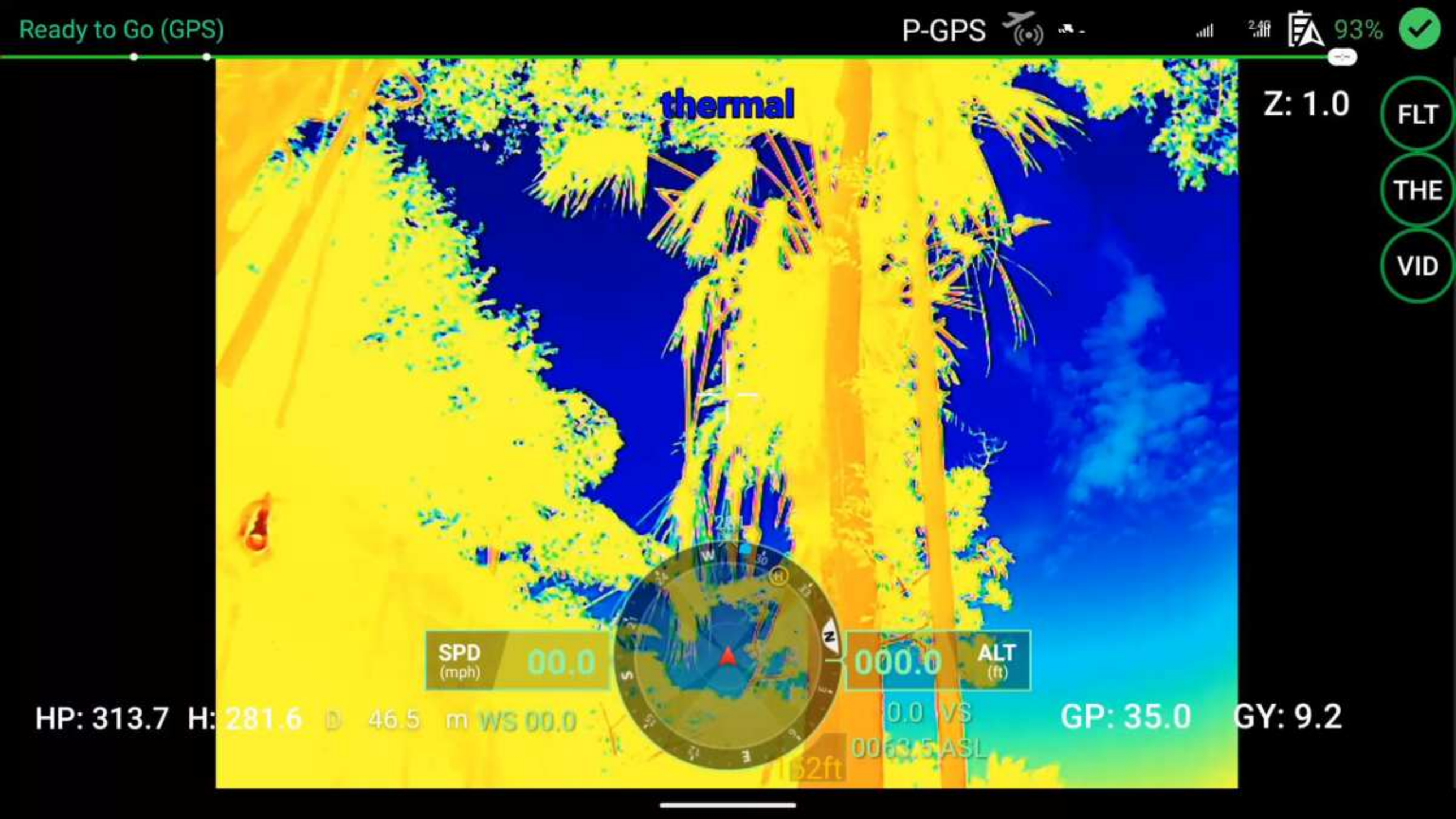
PE SUPER

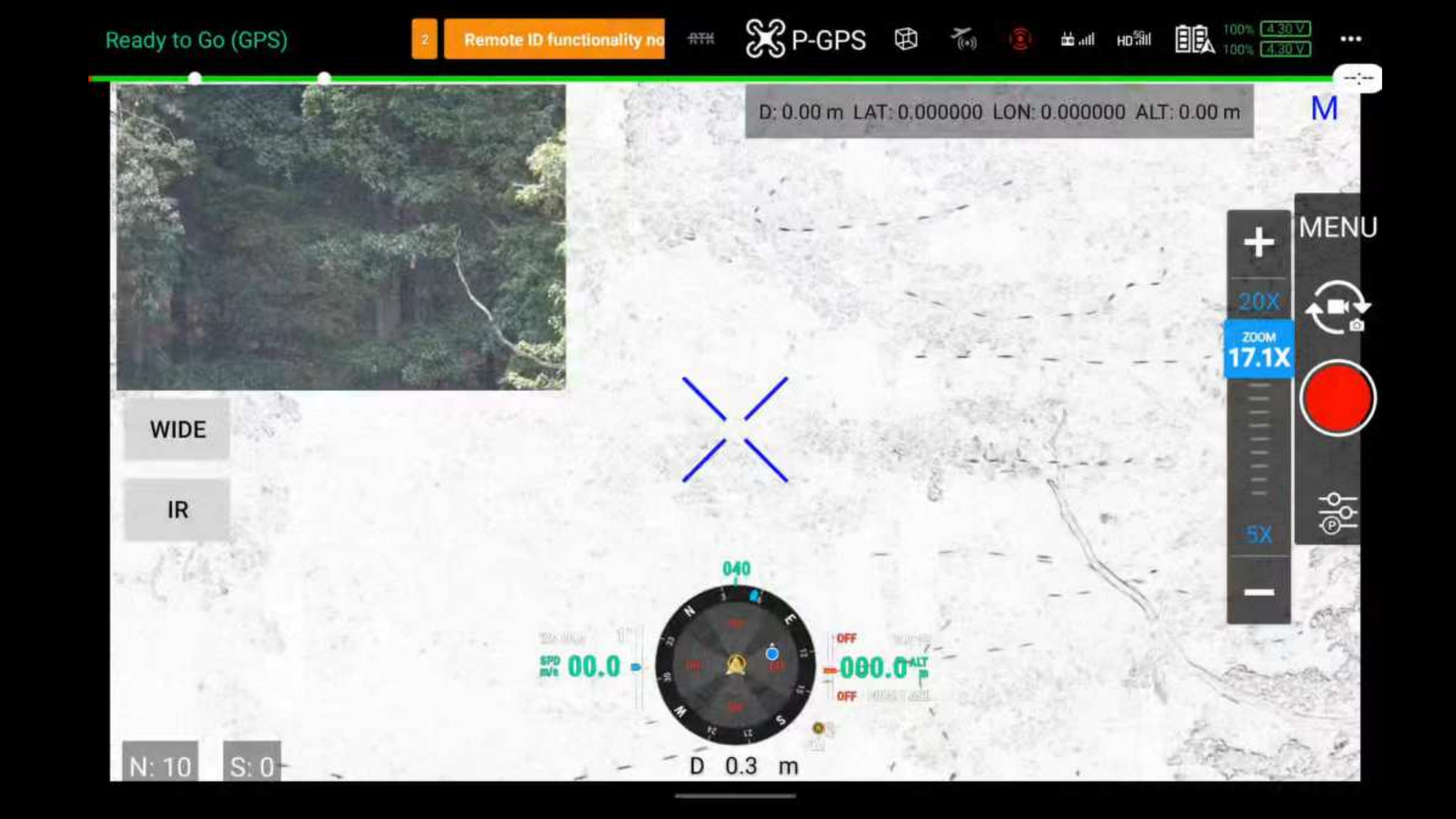

YABI




YABI

What’s Next?

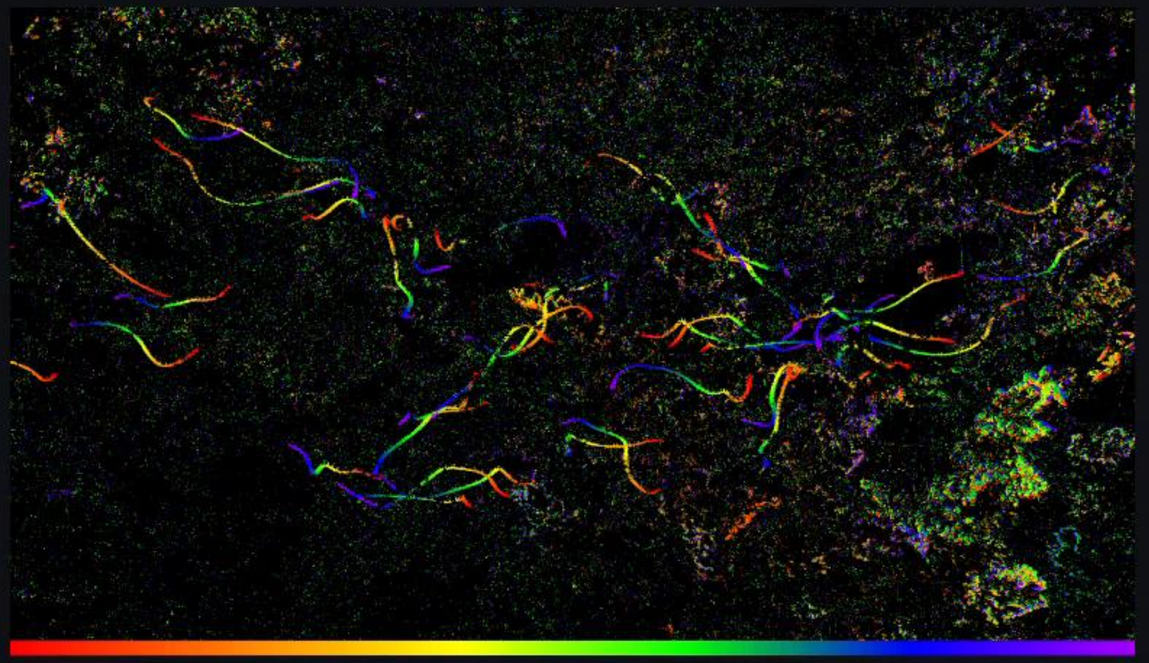

Ready to Go (GPS)
P-GPS
93%
thermal
Z: 1.0
FLT
THE
VID
SPD
(mph)
00.0
000.0
ALT
(ft)
HP: 313.7
H: 281.6
D 46.5 m
WS 00.0
0.0 VS
GP: 35.0
GY: 9.2


Ready to Go (GPS)
2
Remote ID functionality no
P-GPS
100%
4.30 V
100%
4.30 V
D: 0.00 m LAT: 0.000000 LON: 0.000000 ALT: 0.00 m
M
MENU
20X
ZOOM
17.1X
5X
WIDE
IR
040
SPD
m/s
00.0
OFF
000.0
ALT
m
OFF
D 0.3 m
N: 10
S: 0

DEO



TMPt



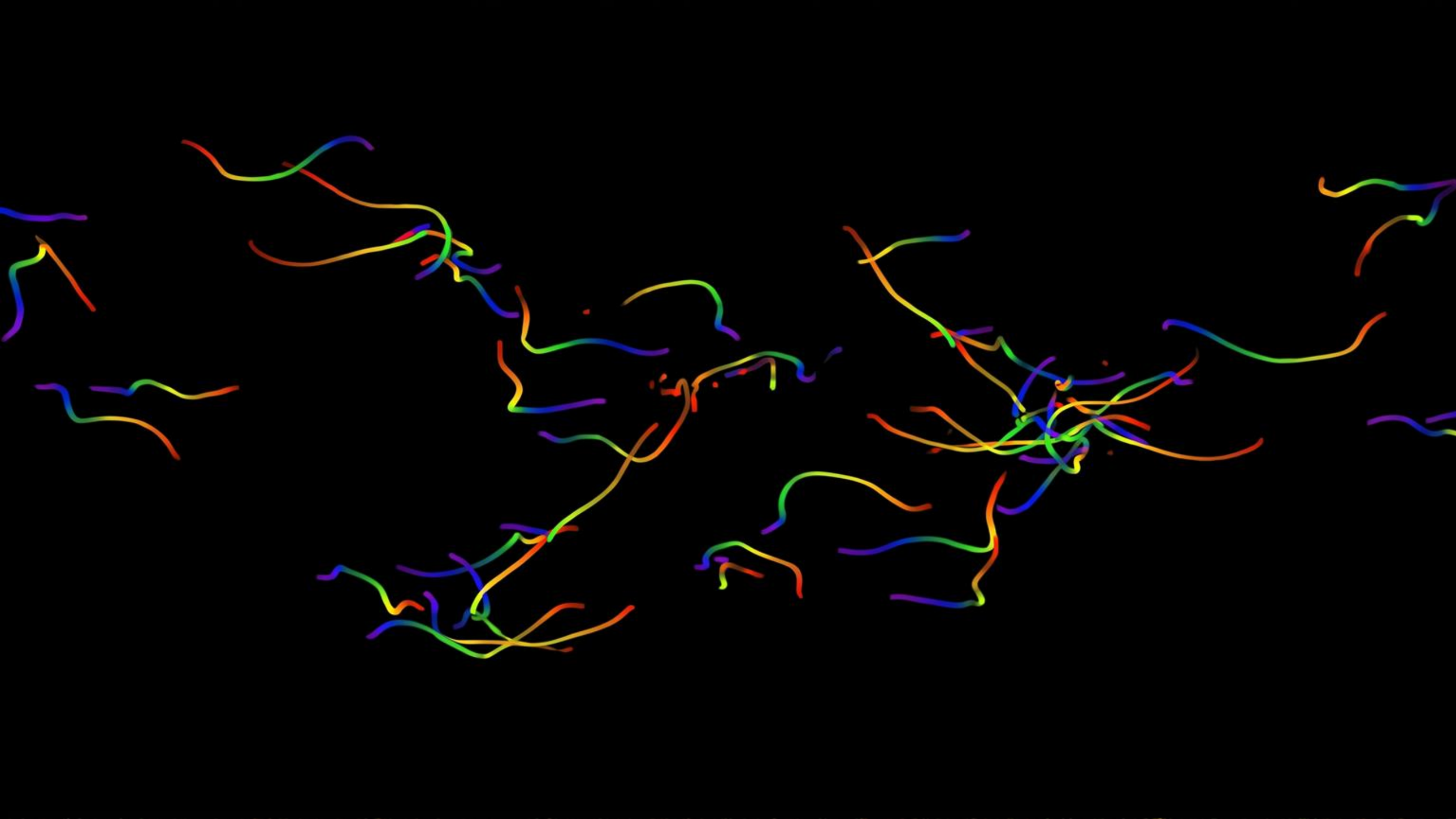
ETECTION

Blobs



TMPv





Science Robotics



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UNIVERSITY OF SUSSEX


FWF
Thank You!