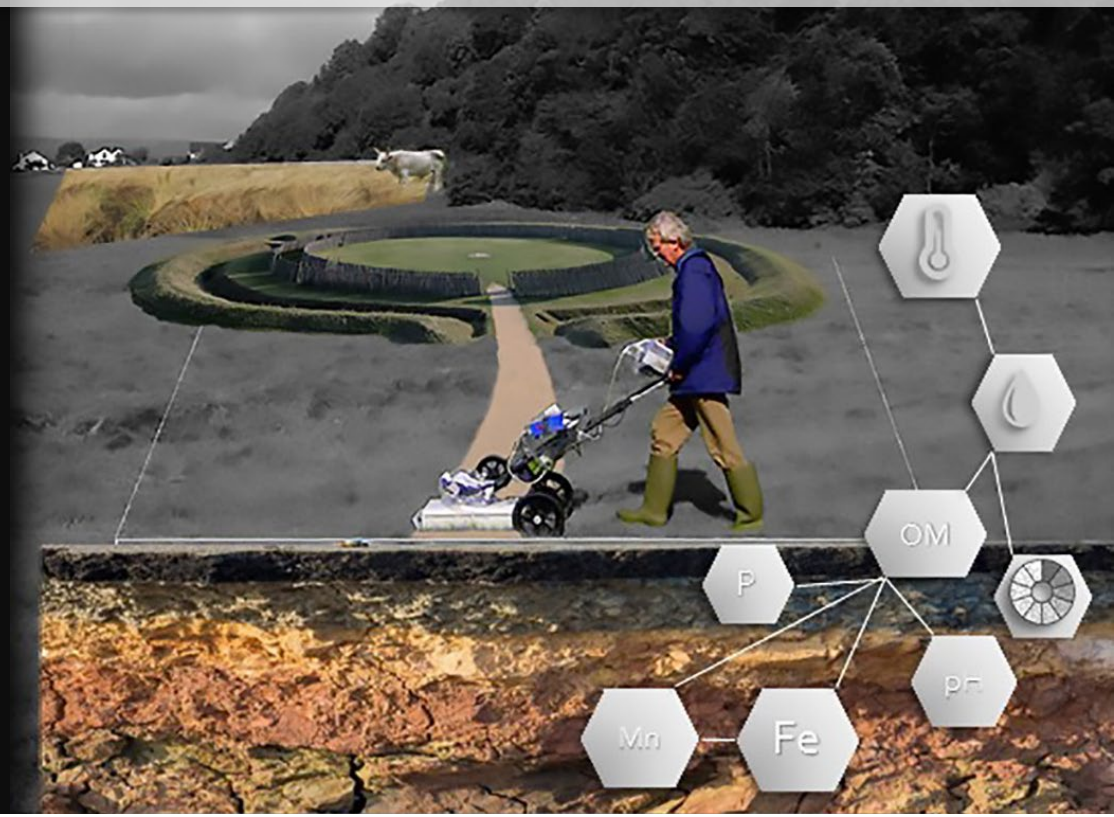
SAGA
The Soil Science & Archaeo-Geophysics Alliance

Training School 1

Processing EMI data
Introduction



GHENT UNIVERSITY

Philippe De Smedt
Ghent University, Belgium

29 Jul - 2 Aug 2019, Auritz/Burguete

cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

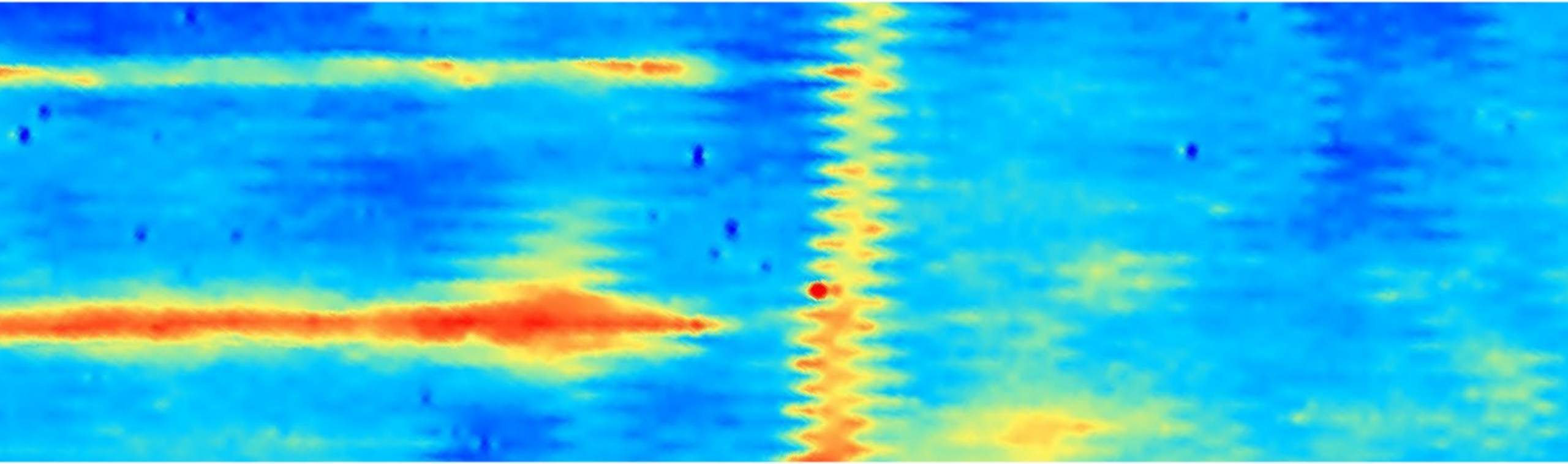
HORIZON 2020

NTNU

FORTH Foundation for Research & Technology - Hellas

GeoSat ReSeArch
Lab of Geophysical-Satellite Remote Sensing and Archaeoenvironment

Problem 1: staggering



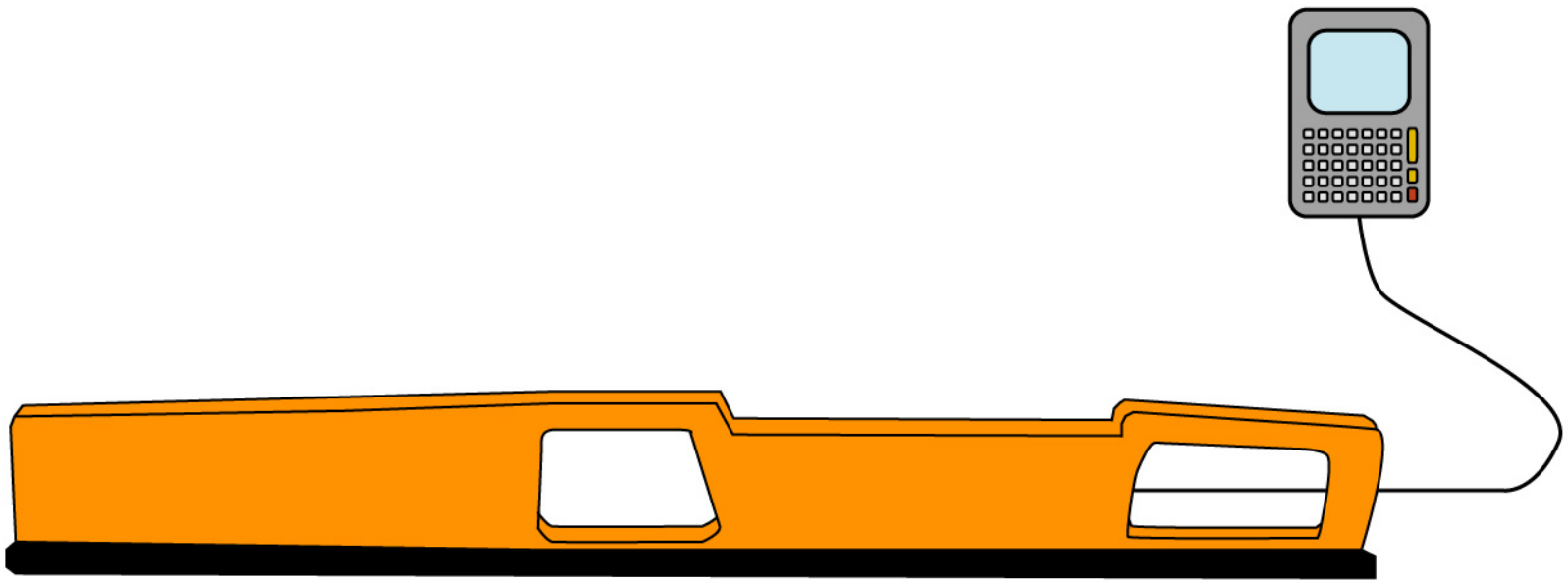
Problem 1: staggering

Causes:

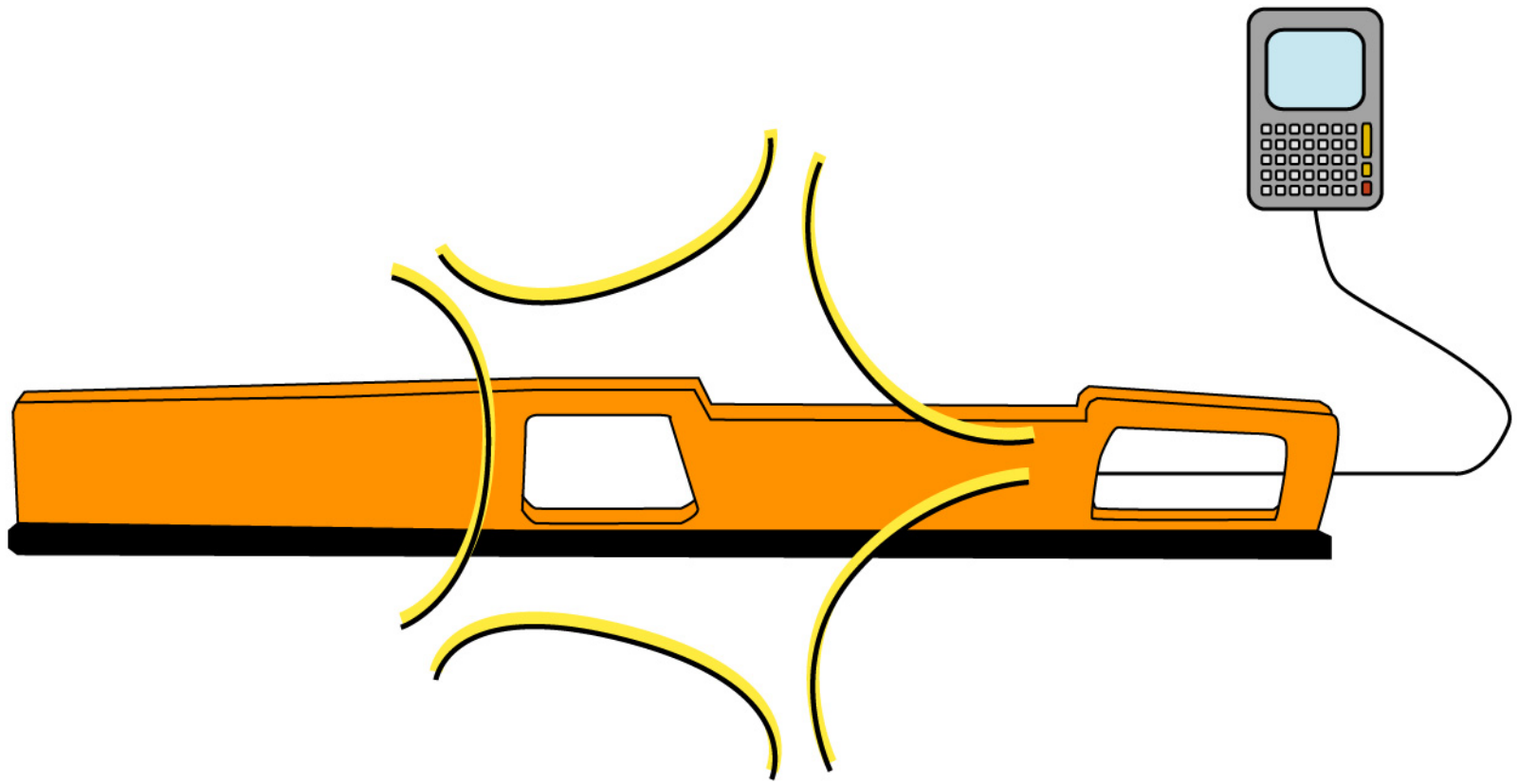
1. Sensor position (georeferencing)

2. Instrument characteristics

Measurement lag



Measurement lag



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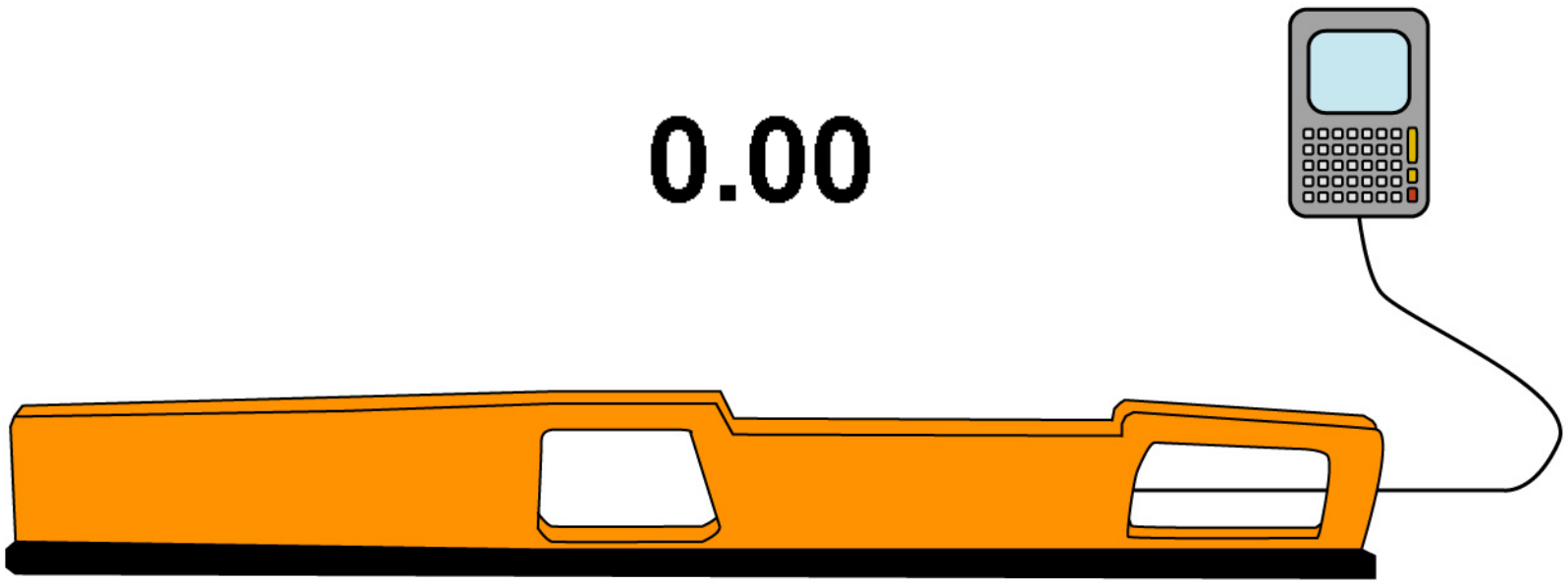

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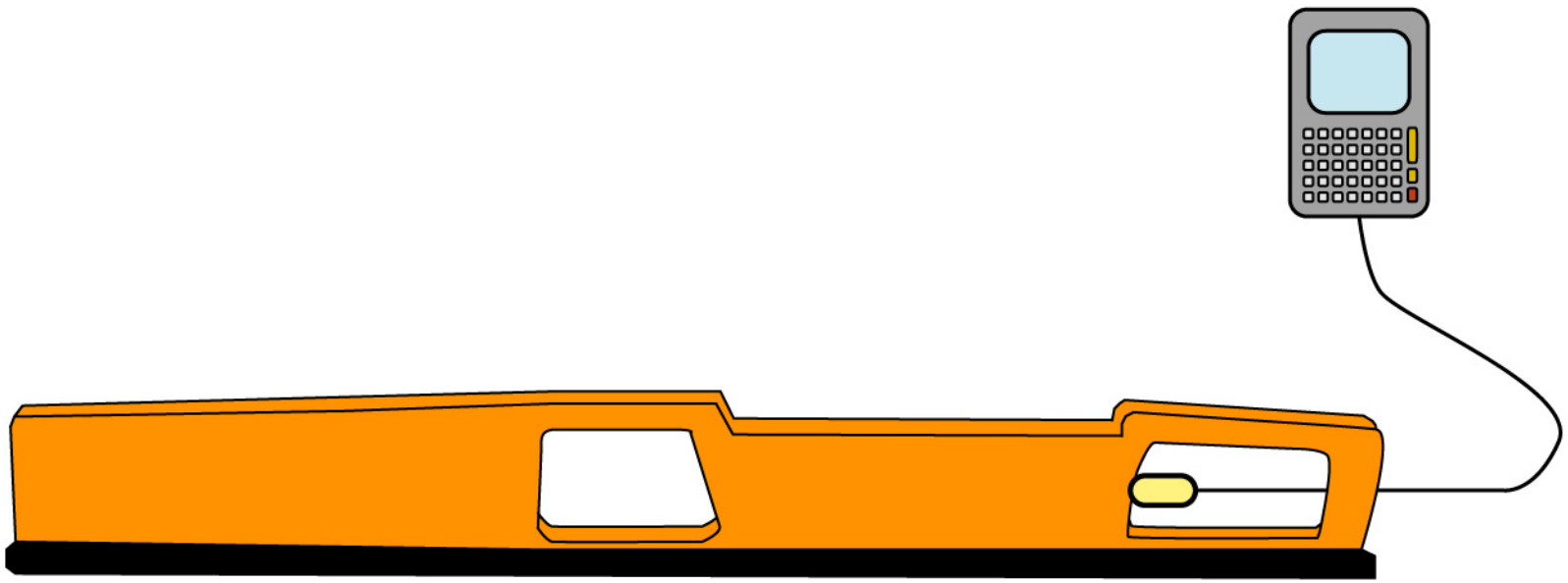
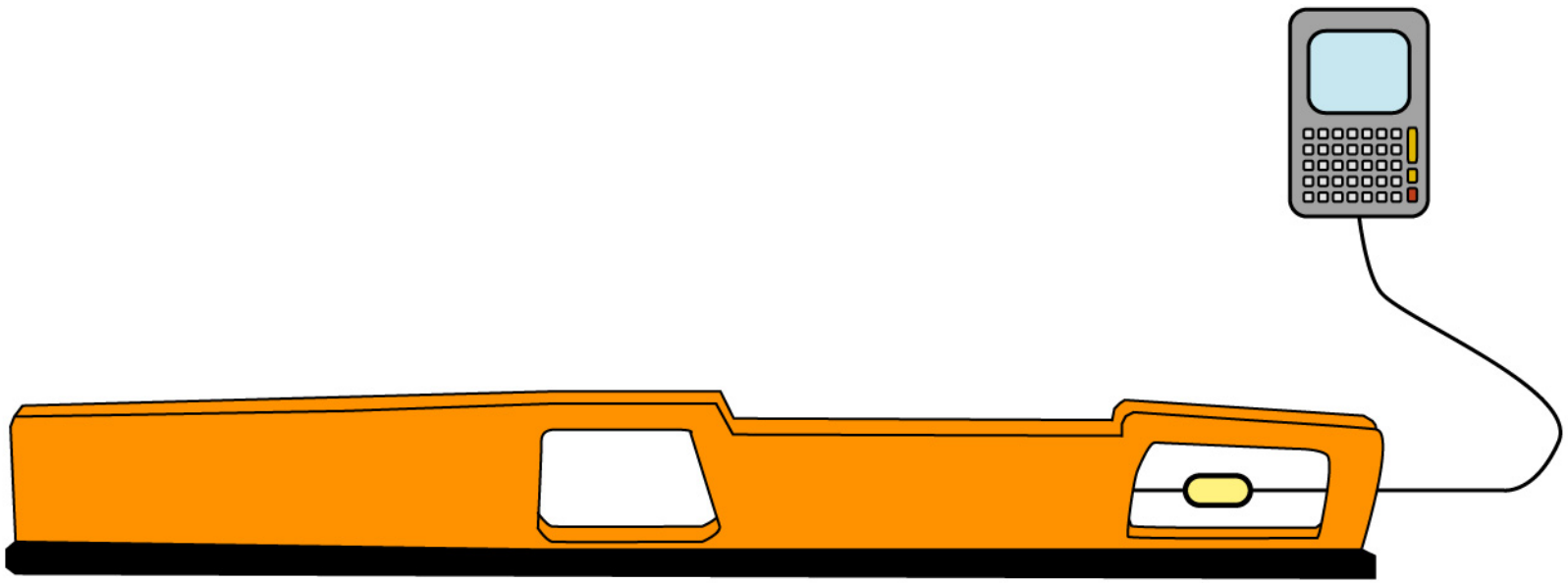


Measurement lag



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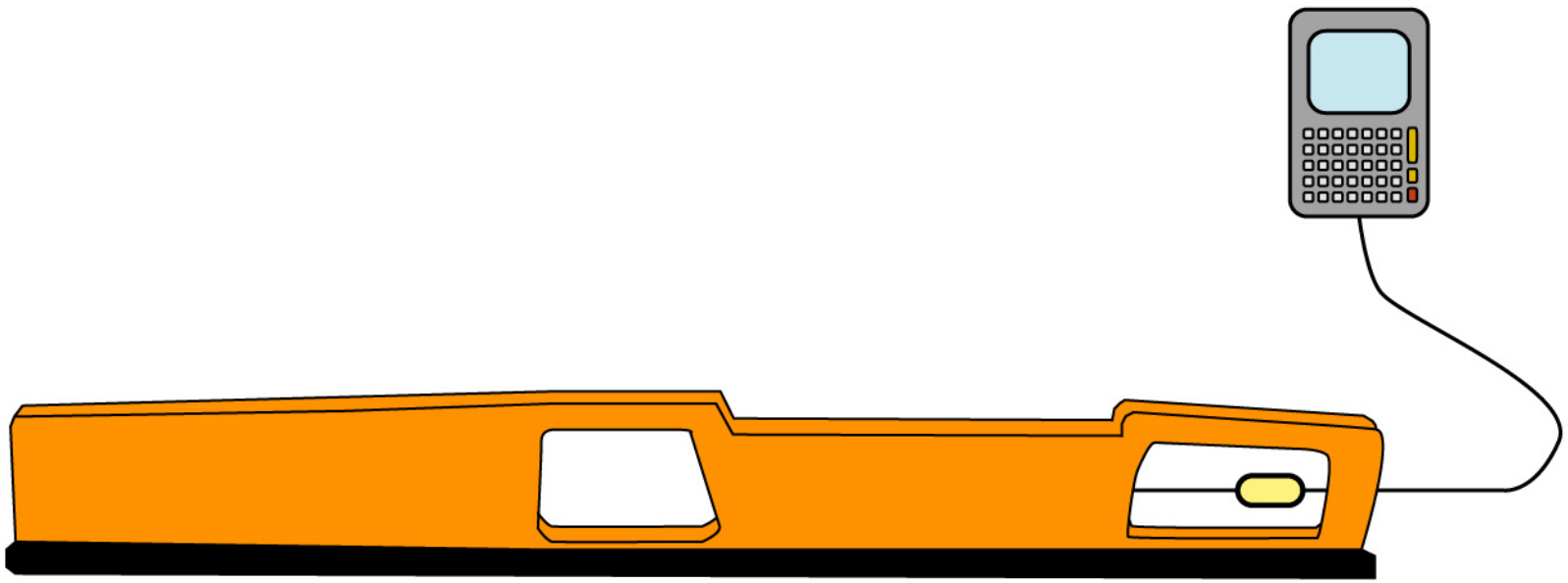

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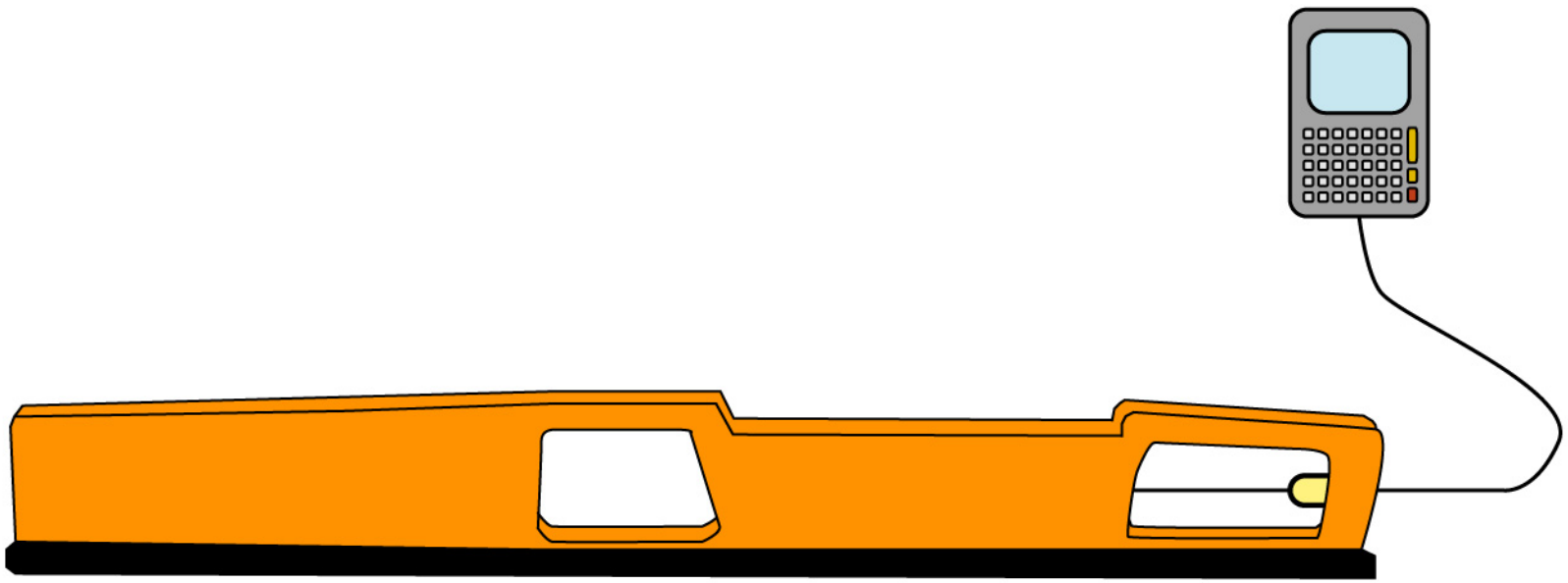
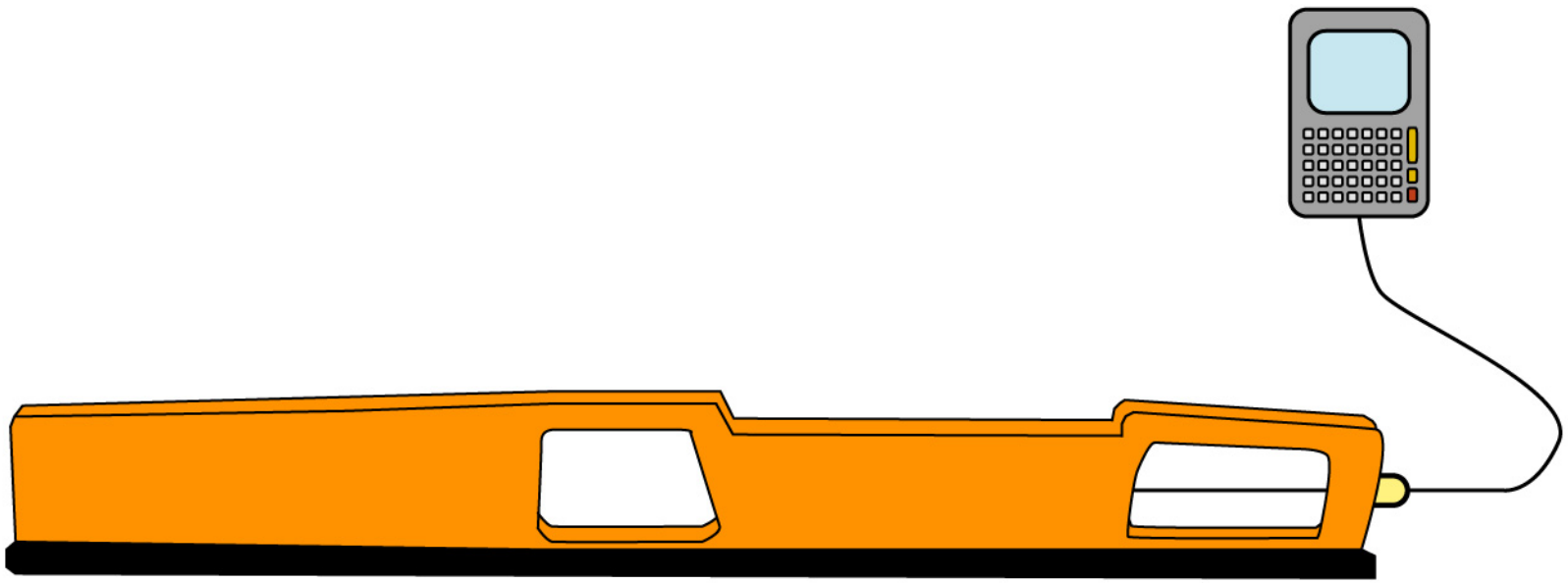


Measurement lag



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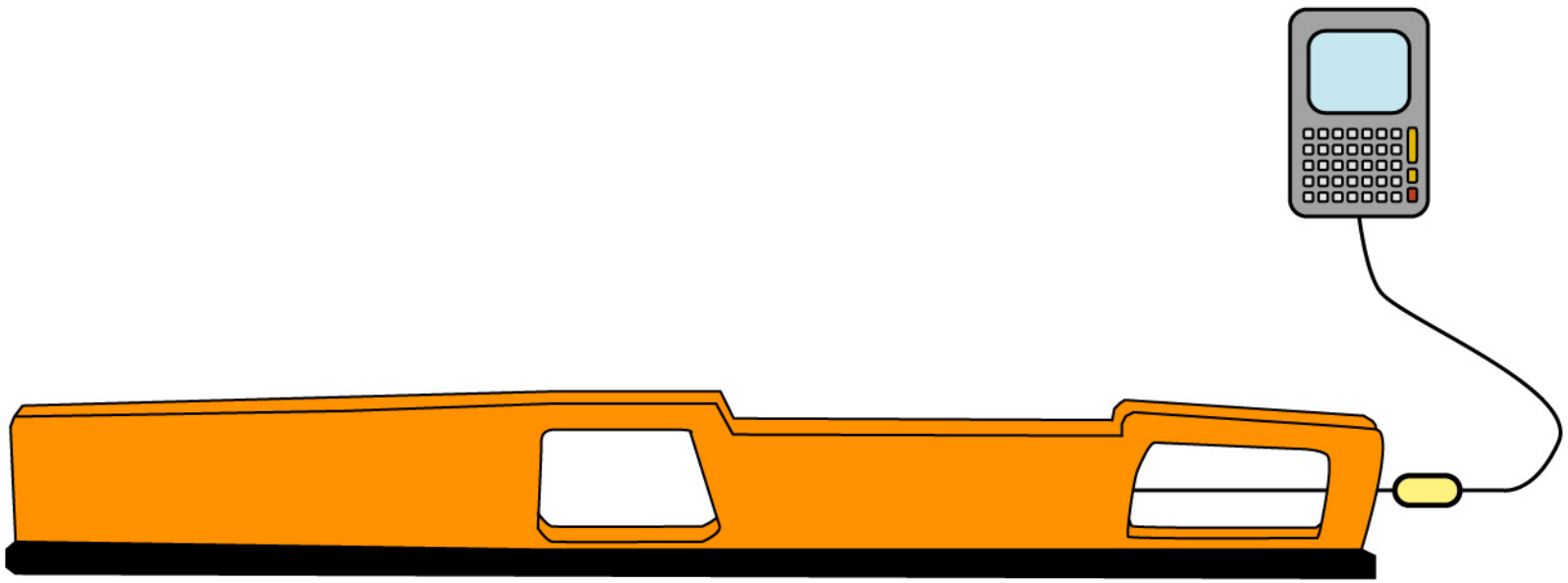

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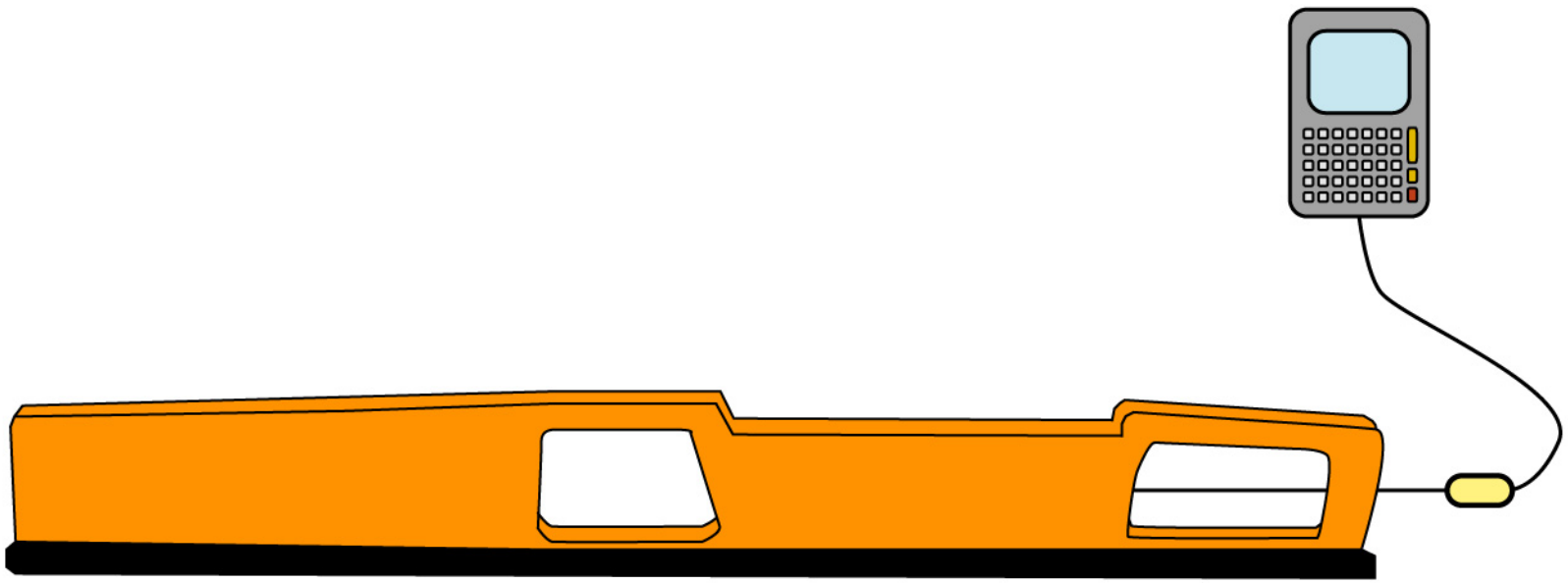

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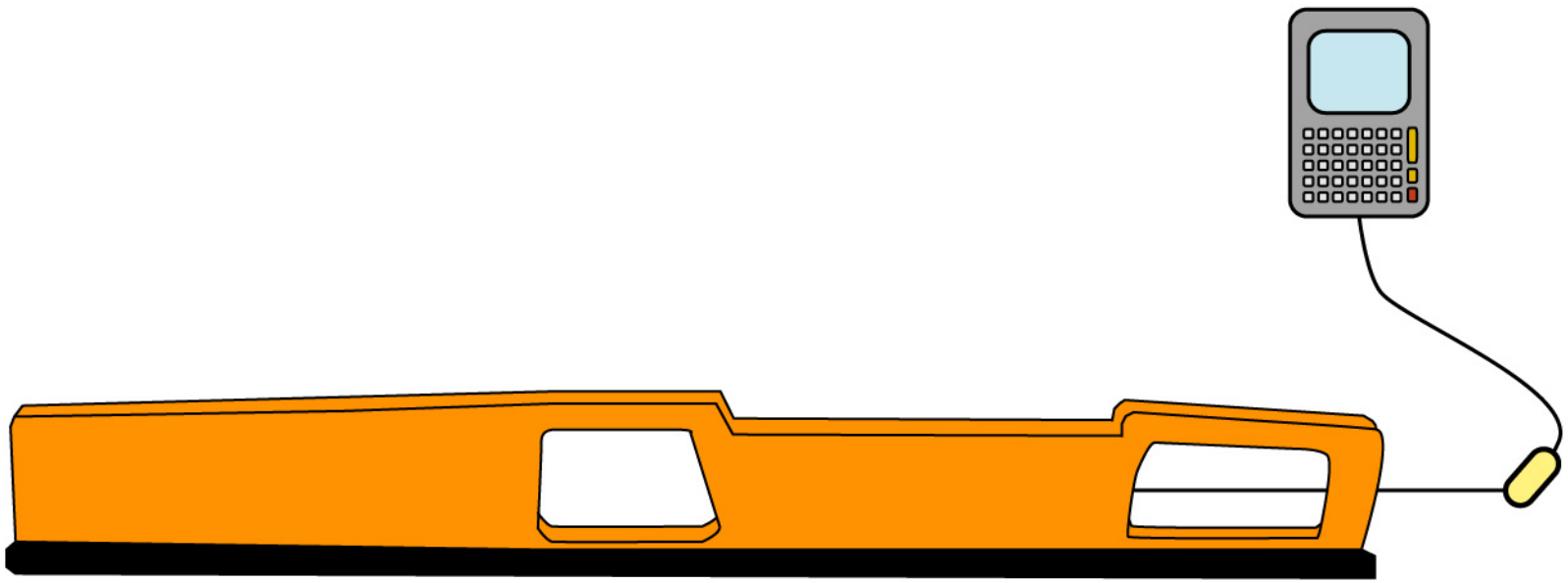

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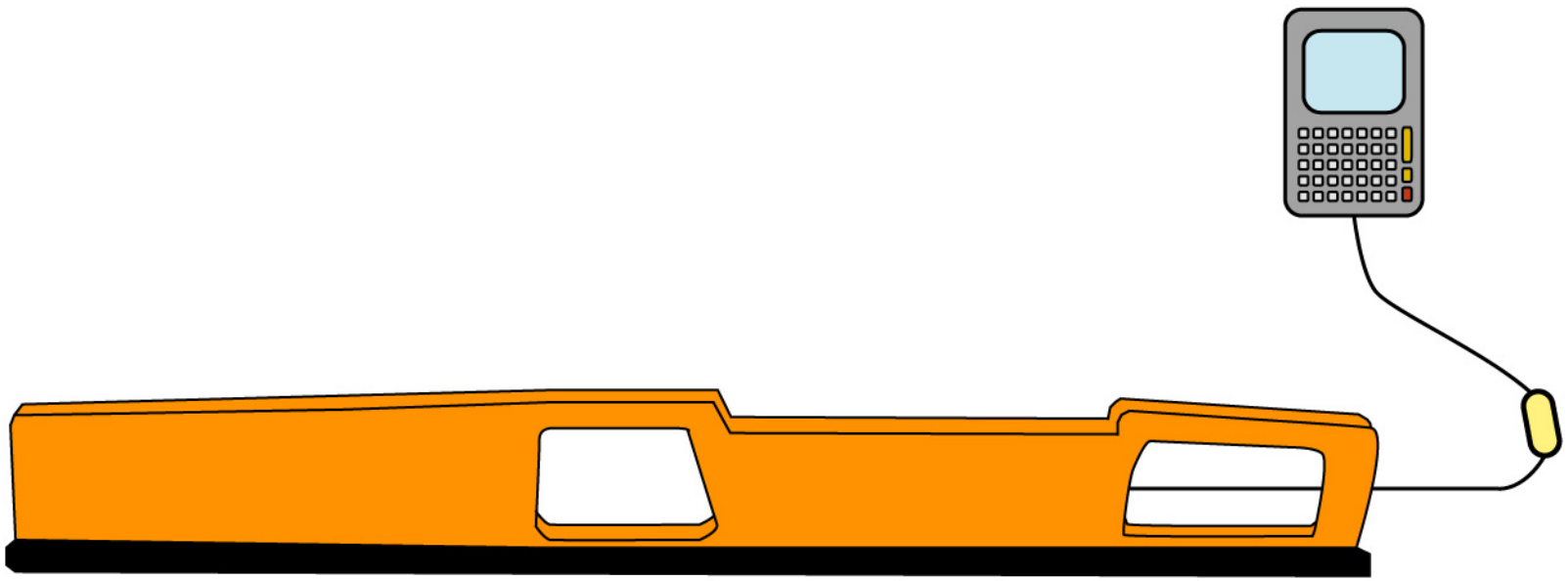

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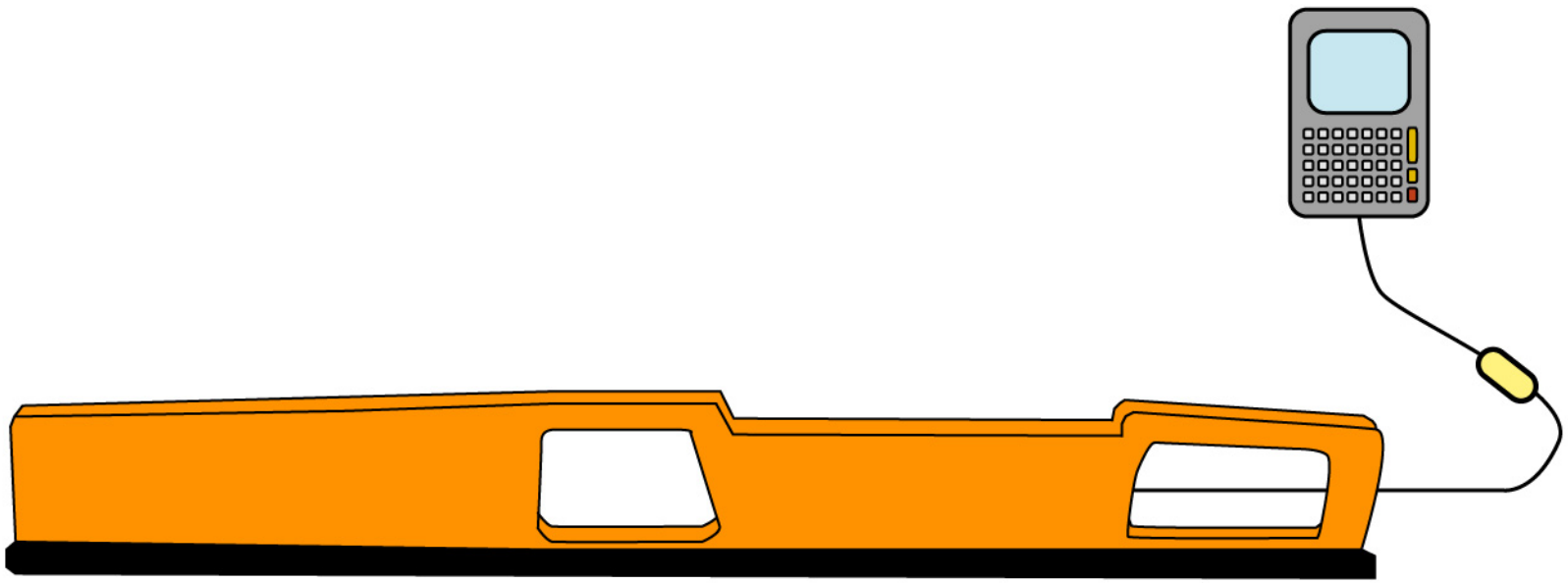

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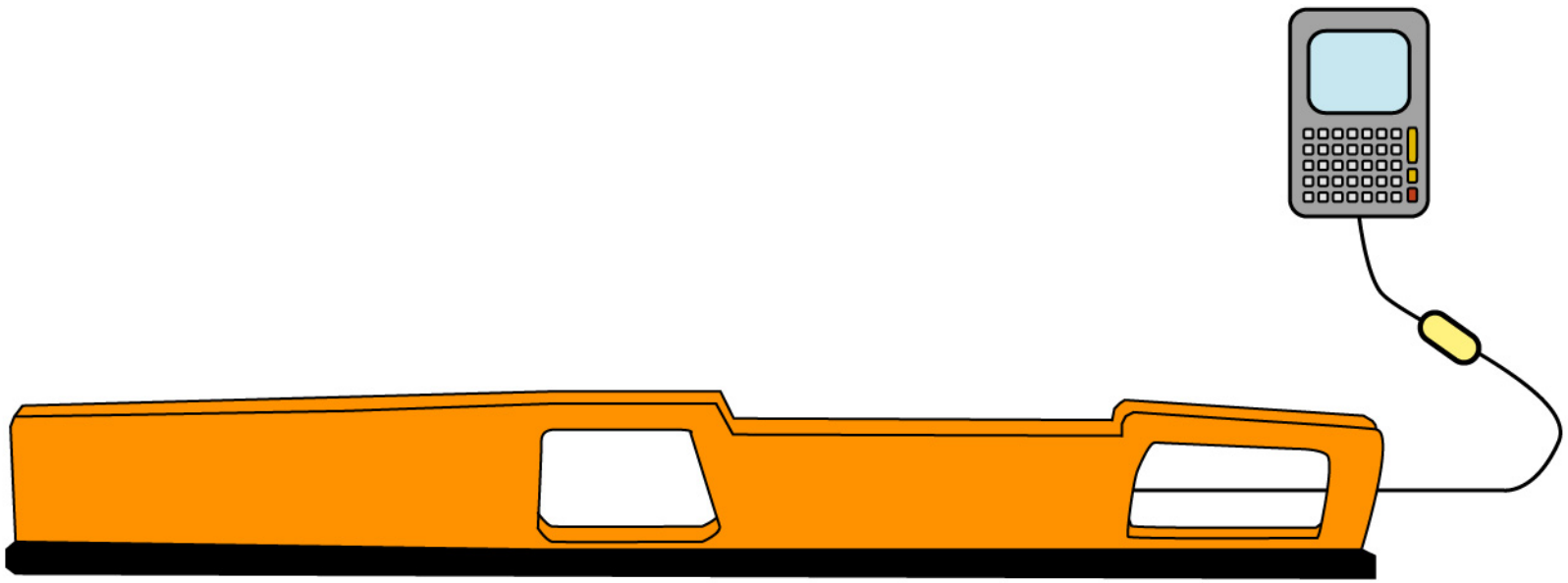

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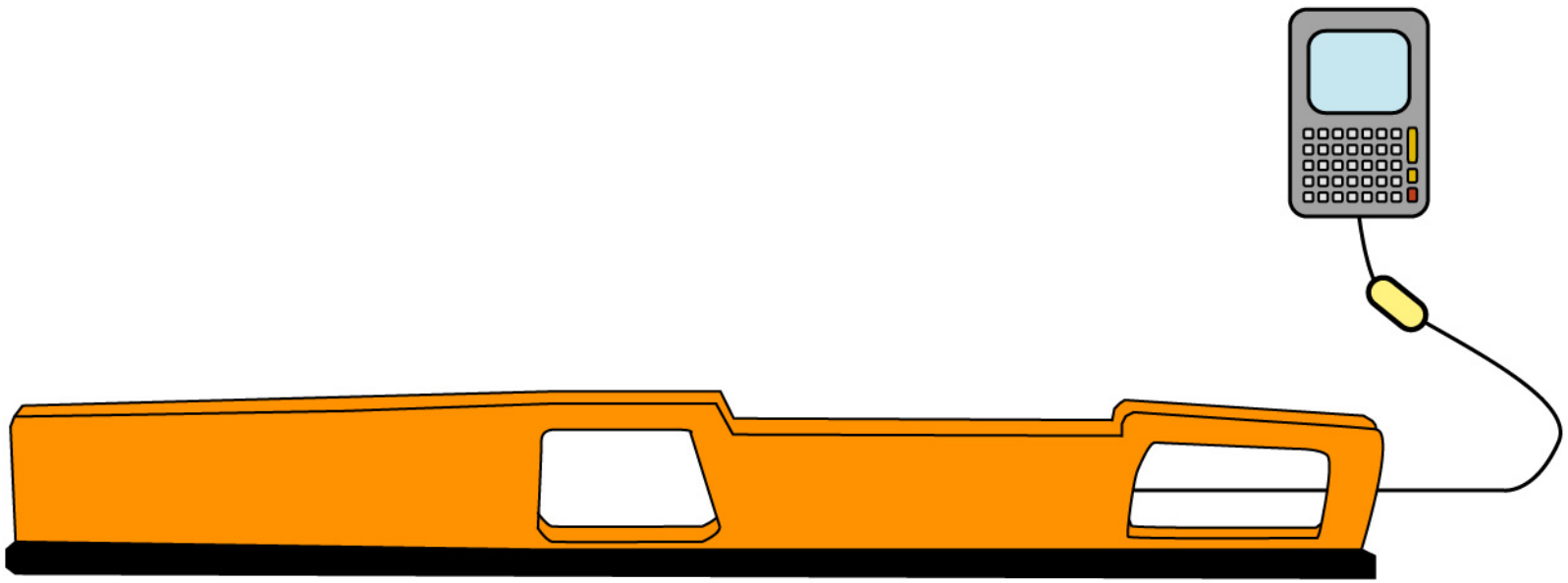

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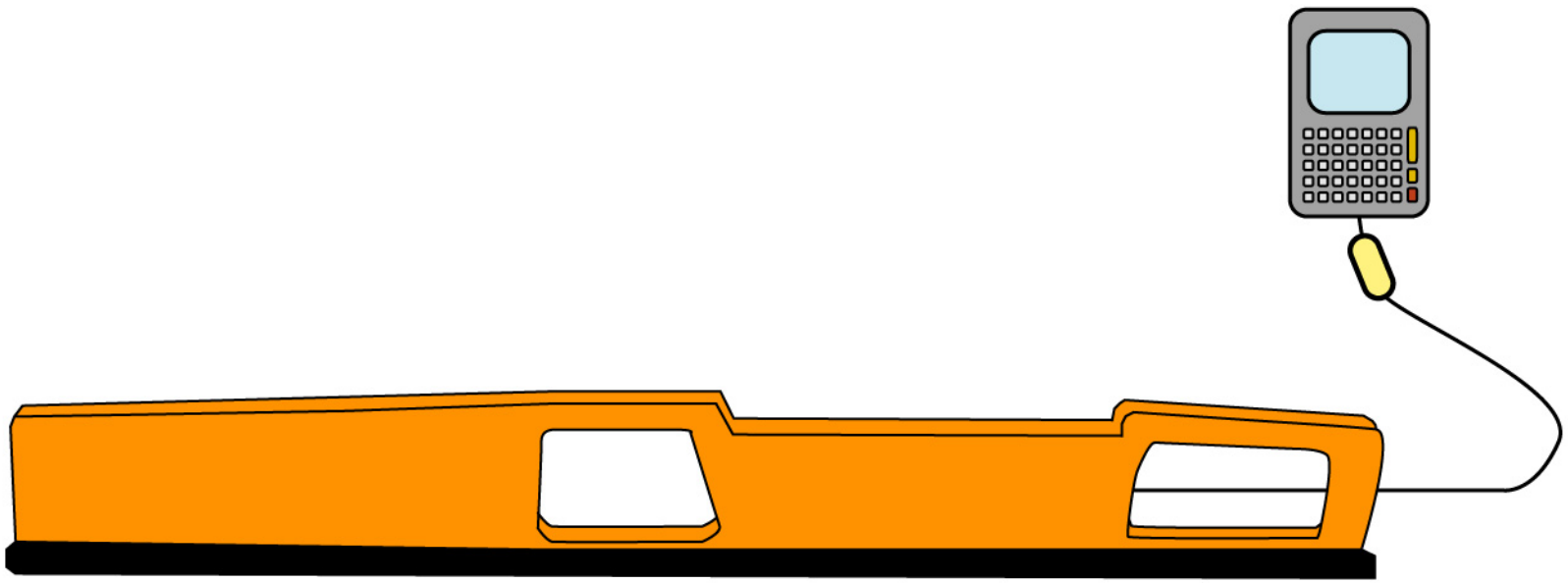

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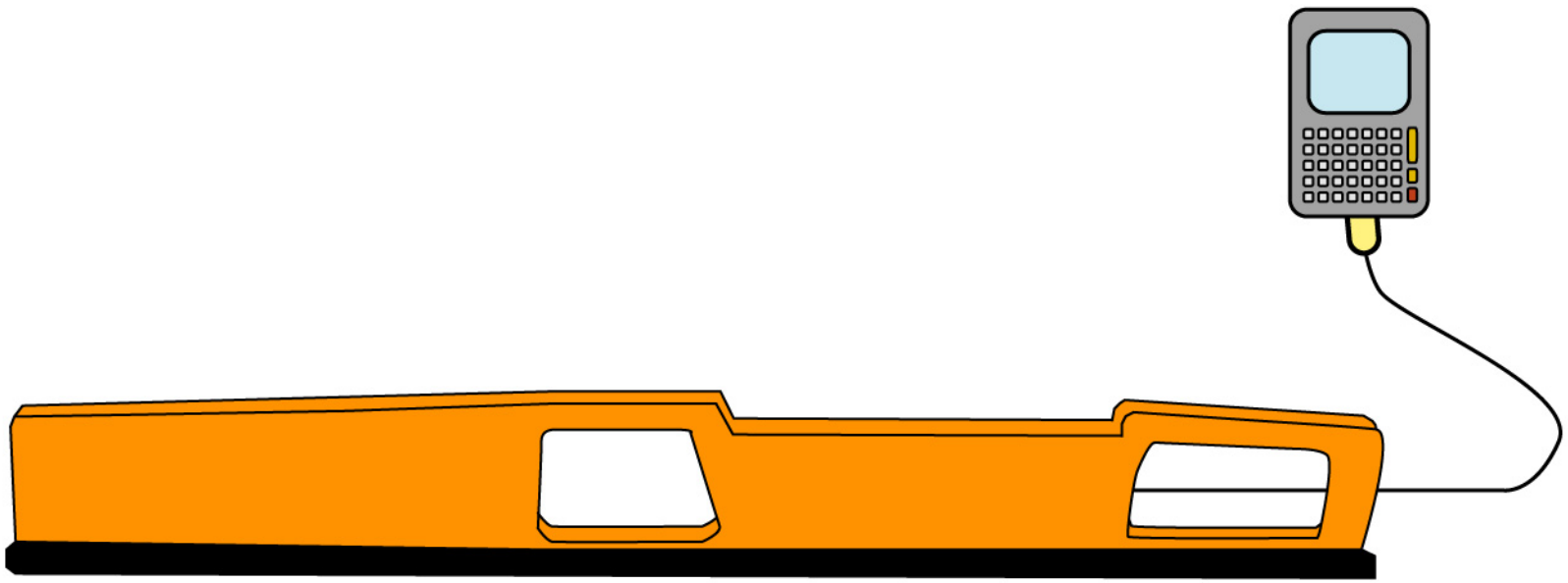

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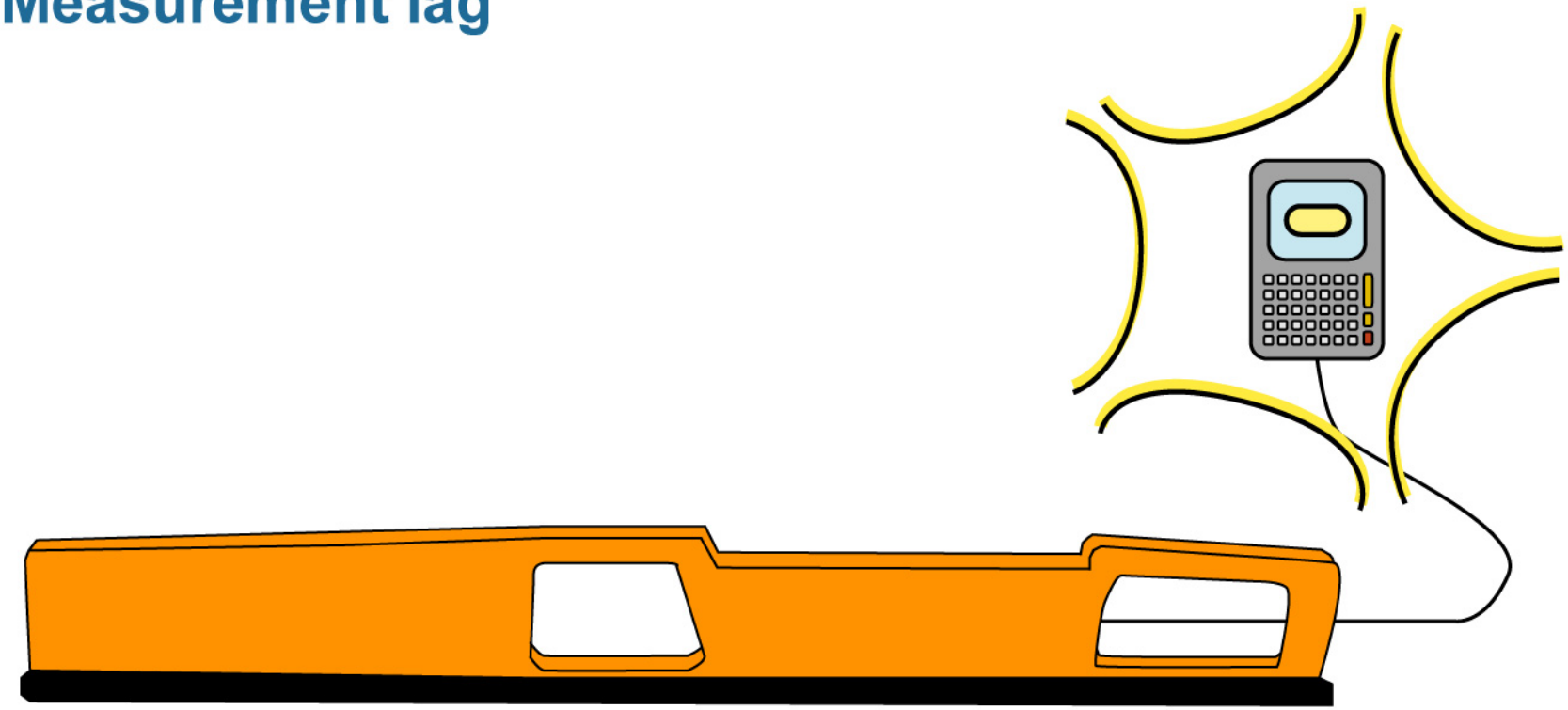

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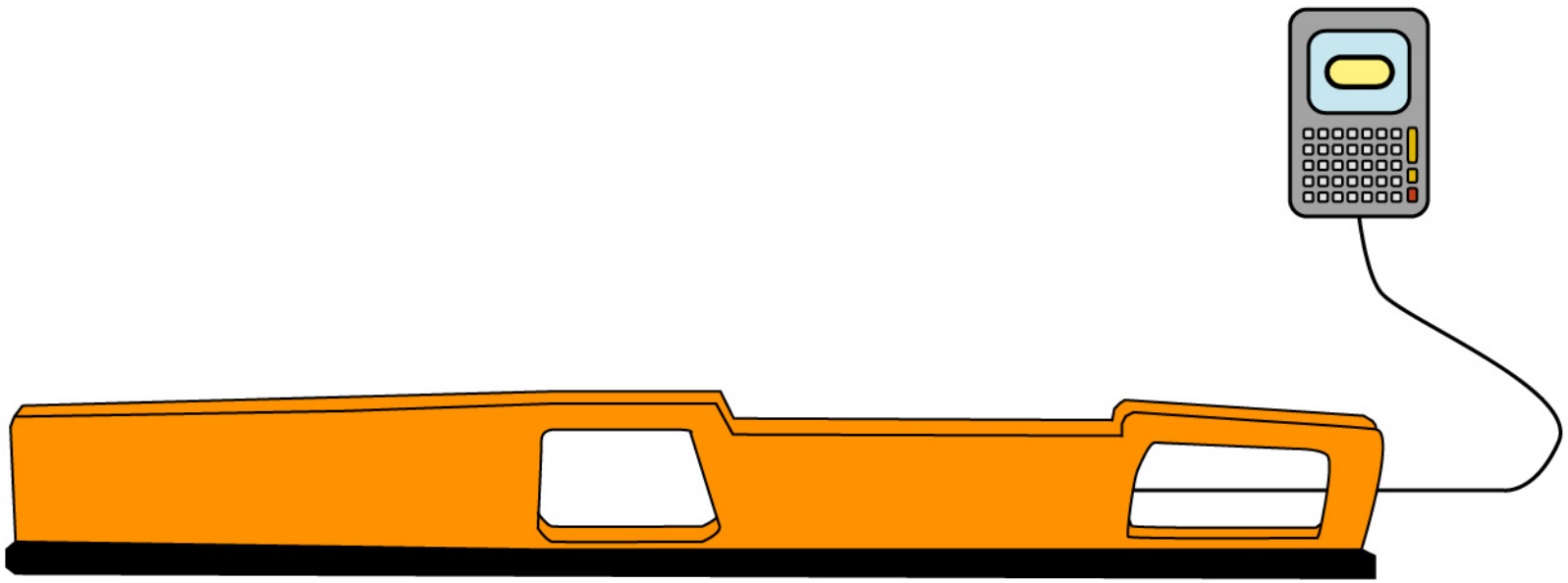

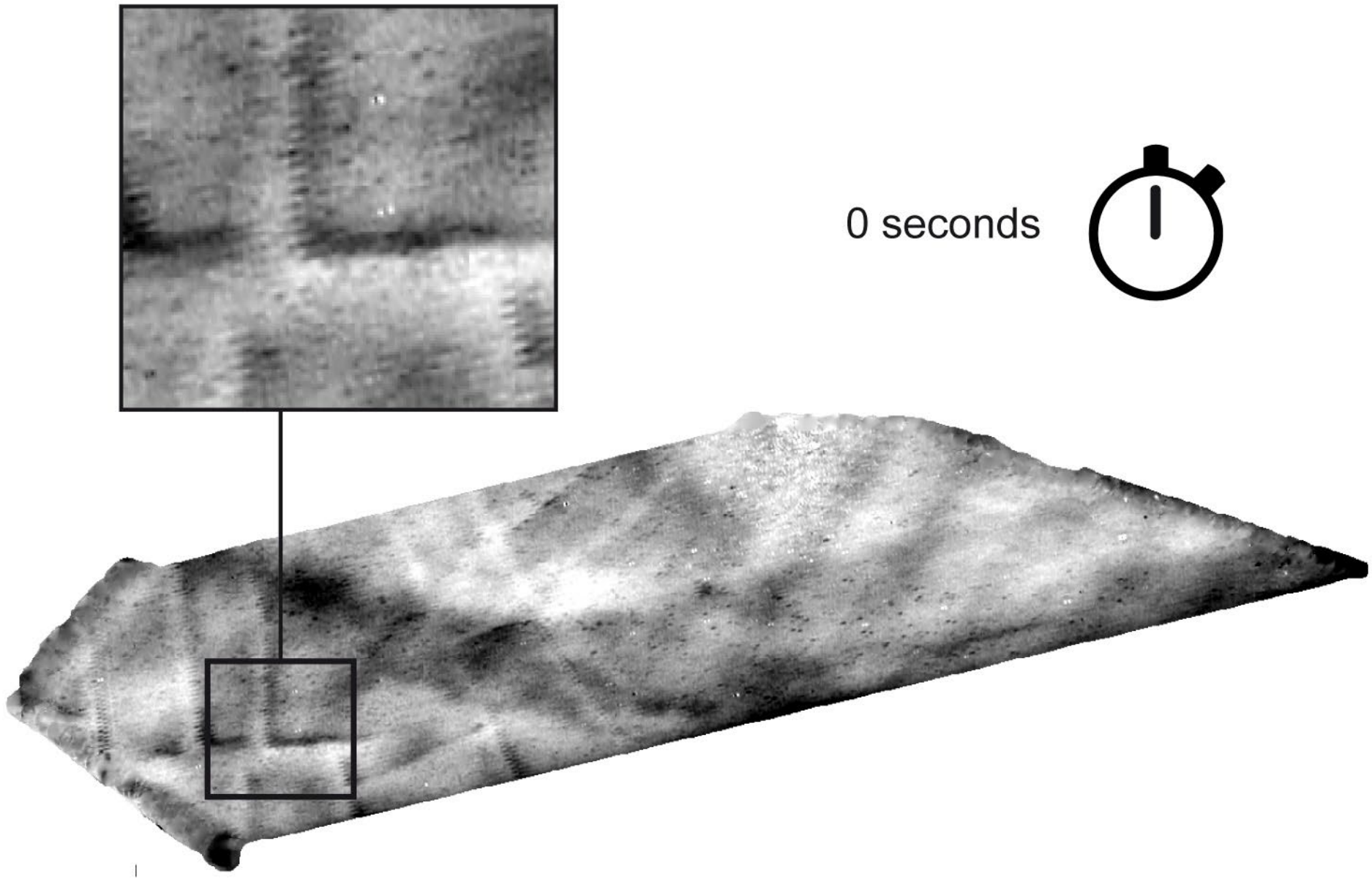
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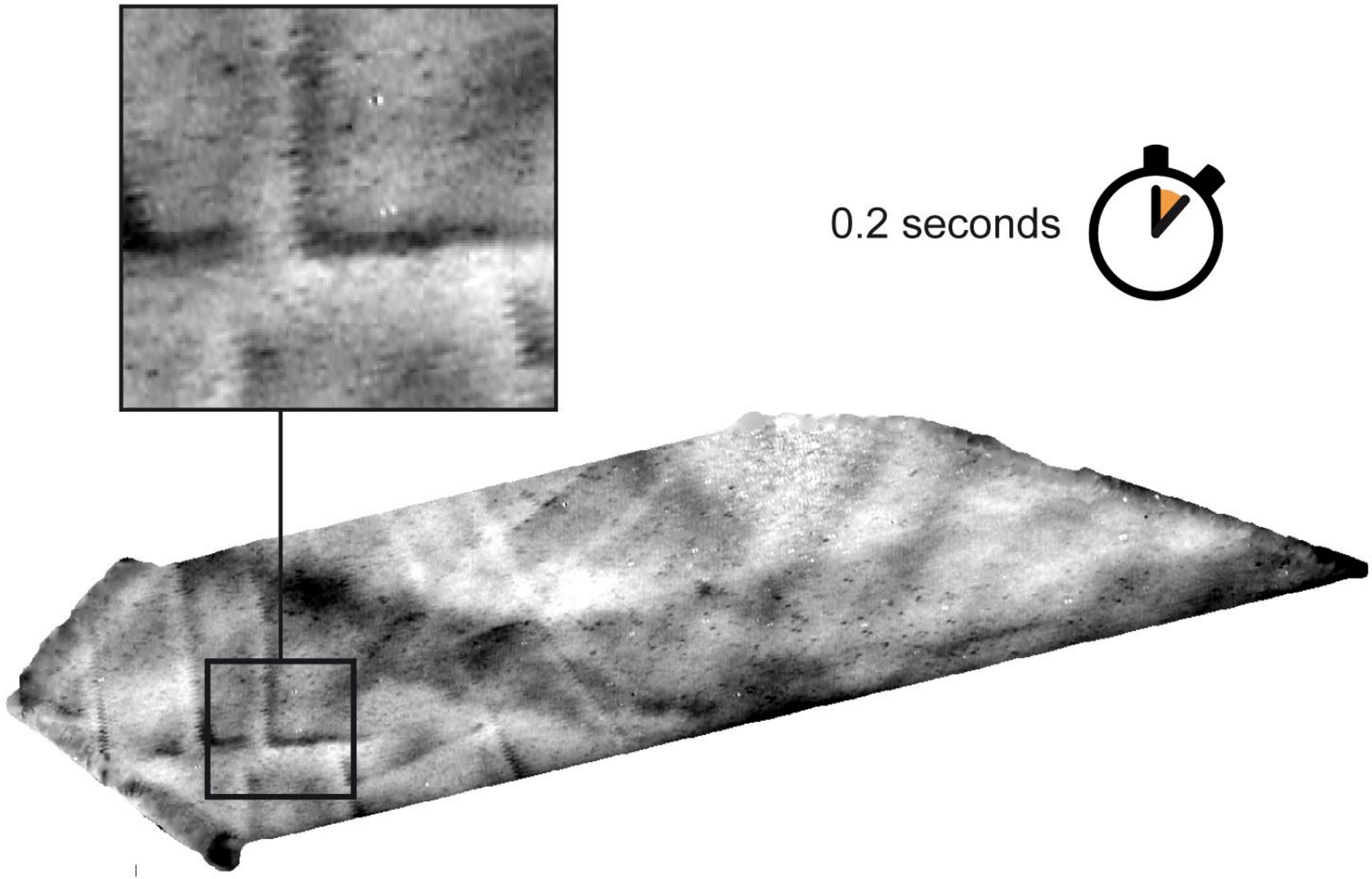
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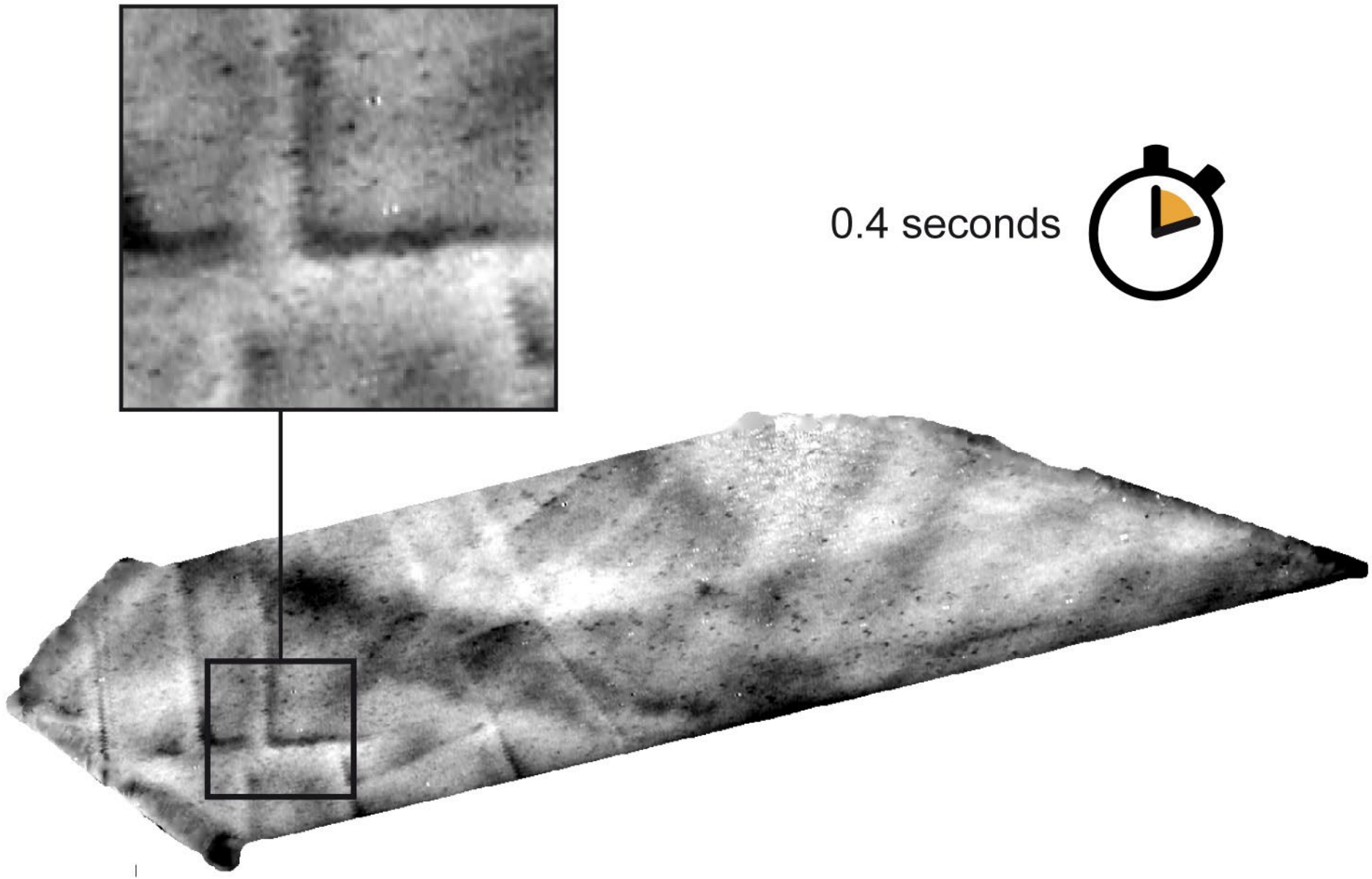
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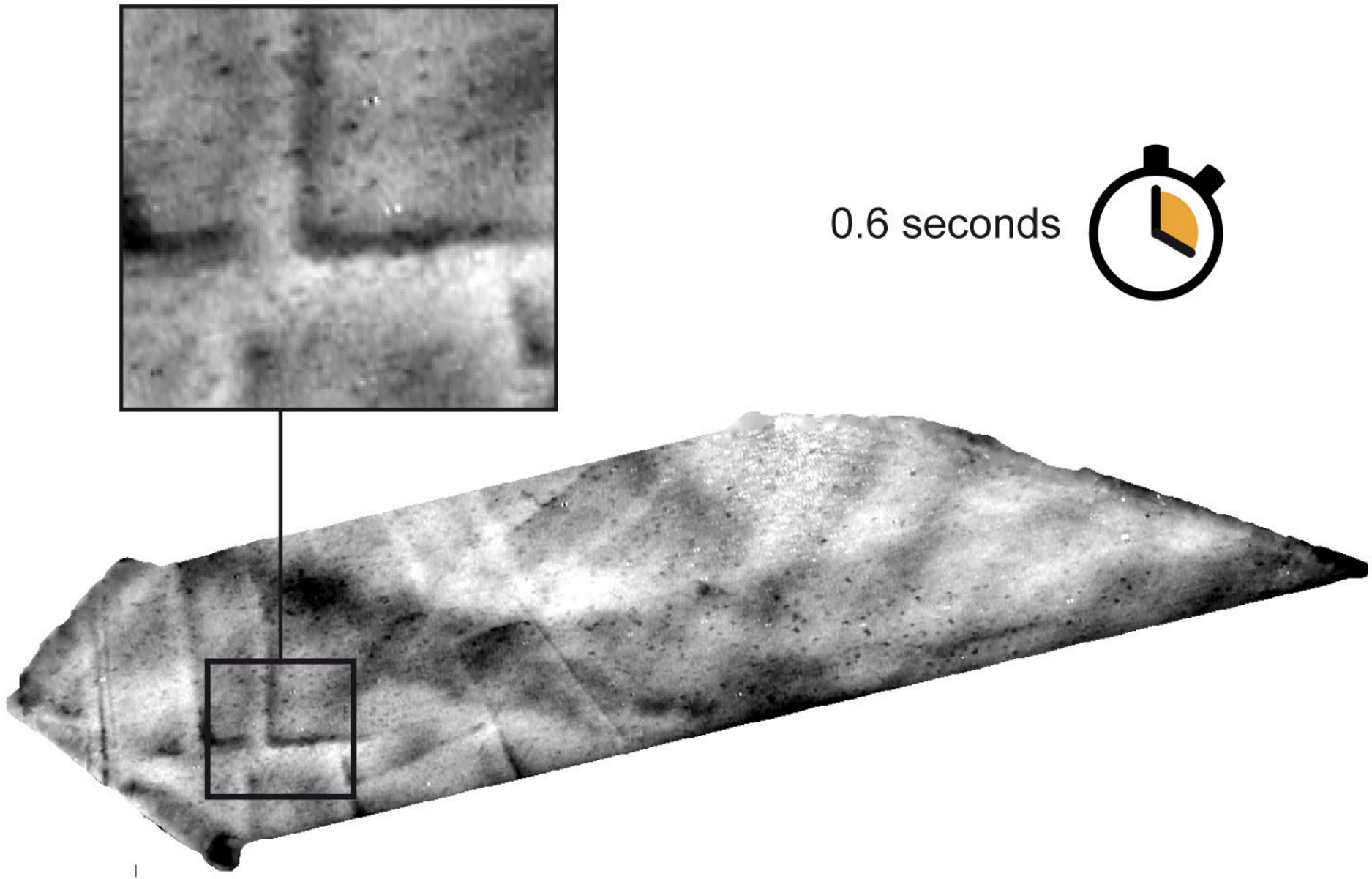
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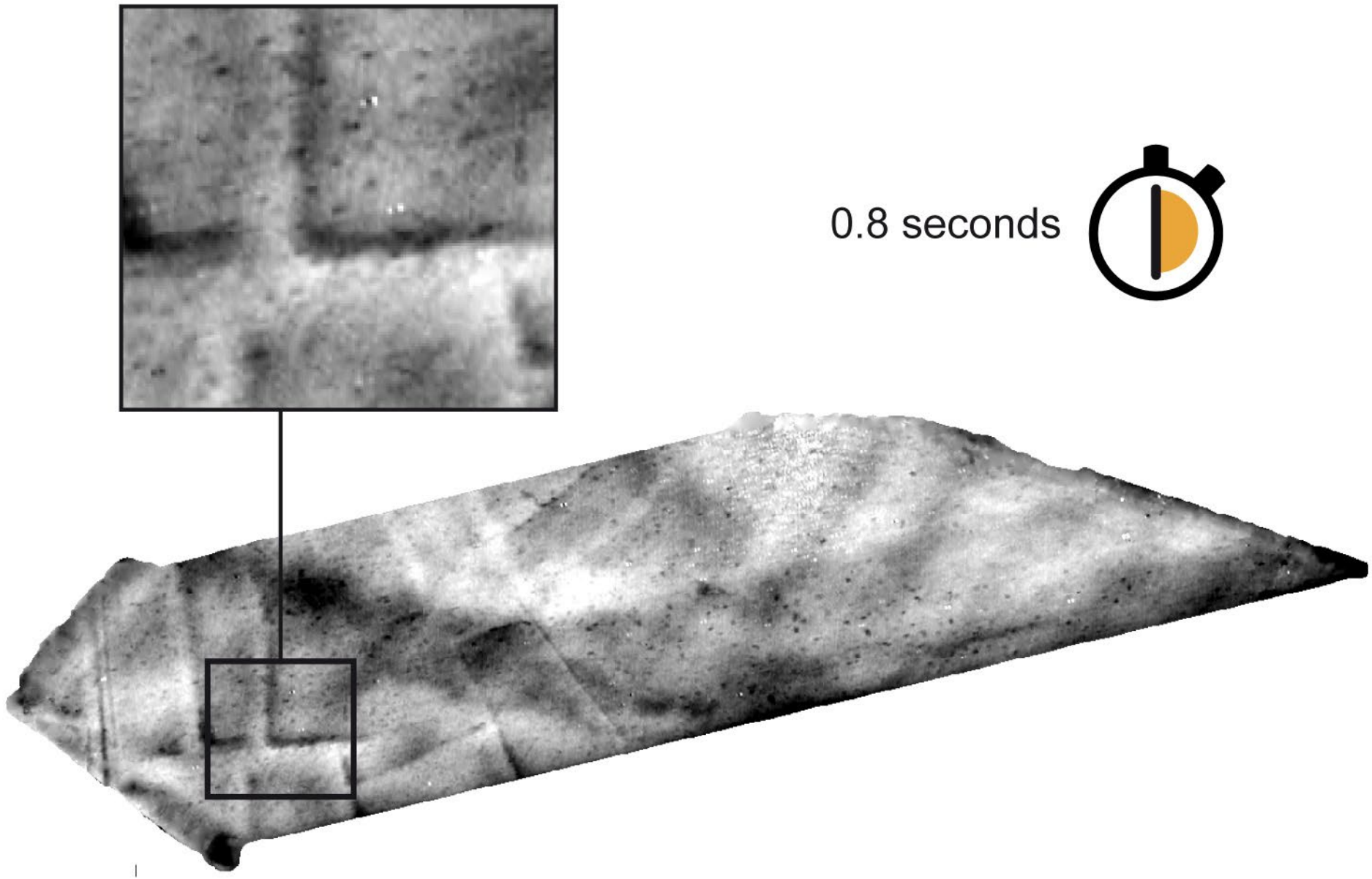
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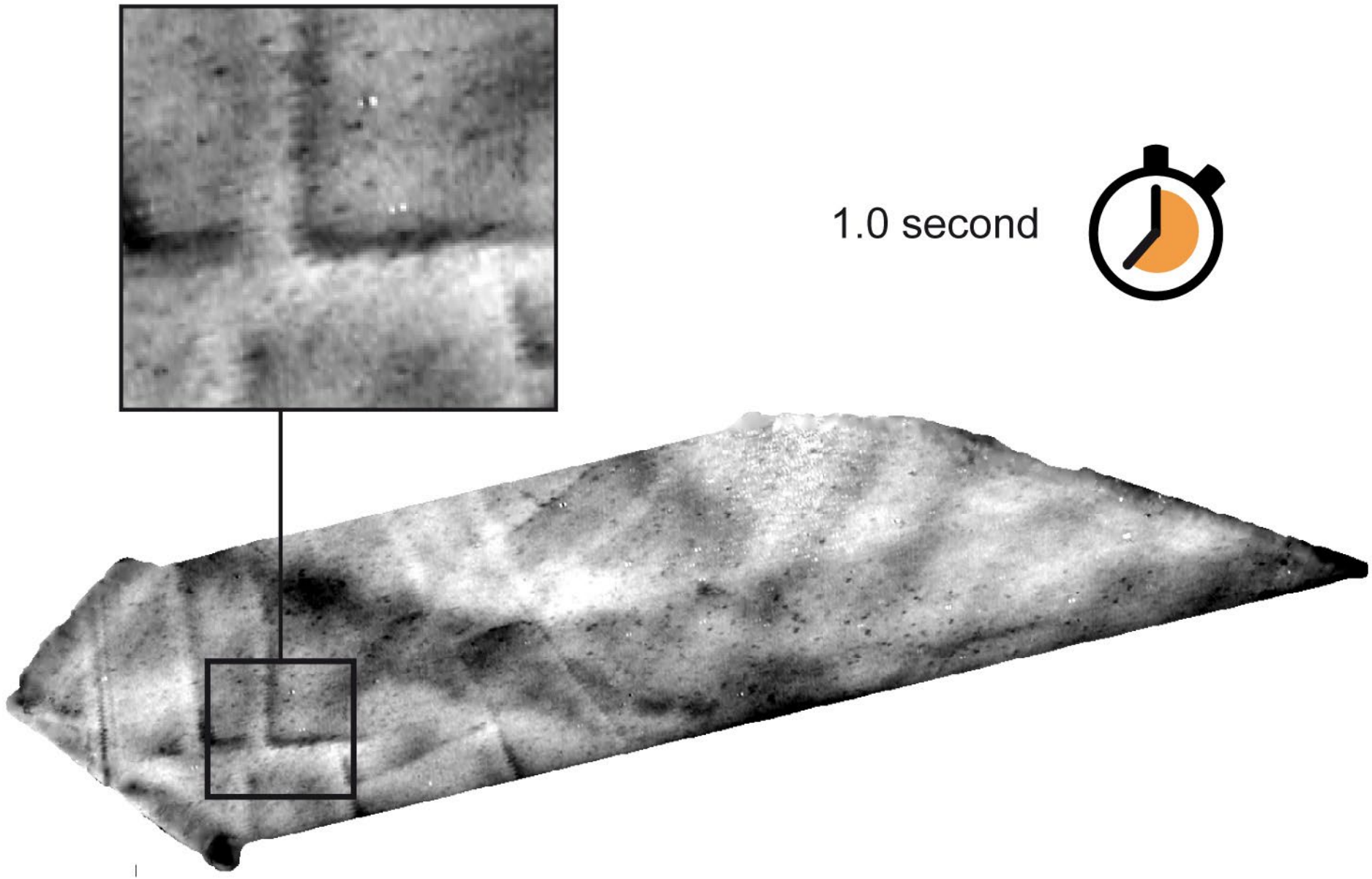
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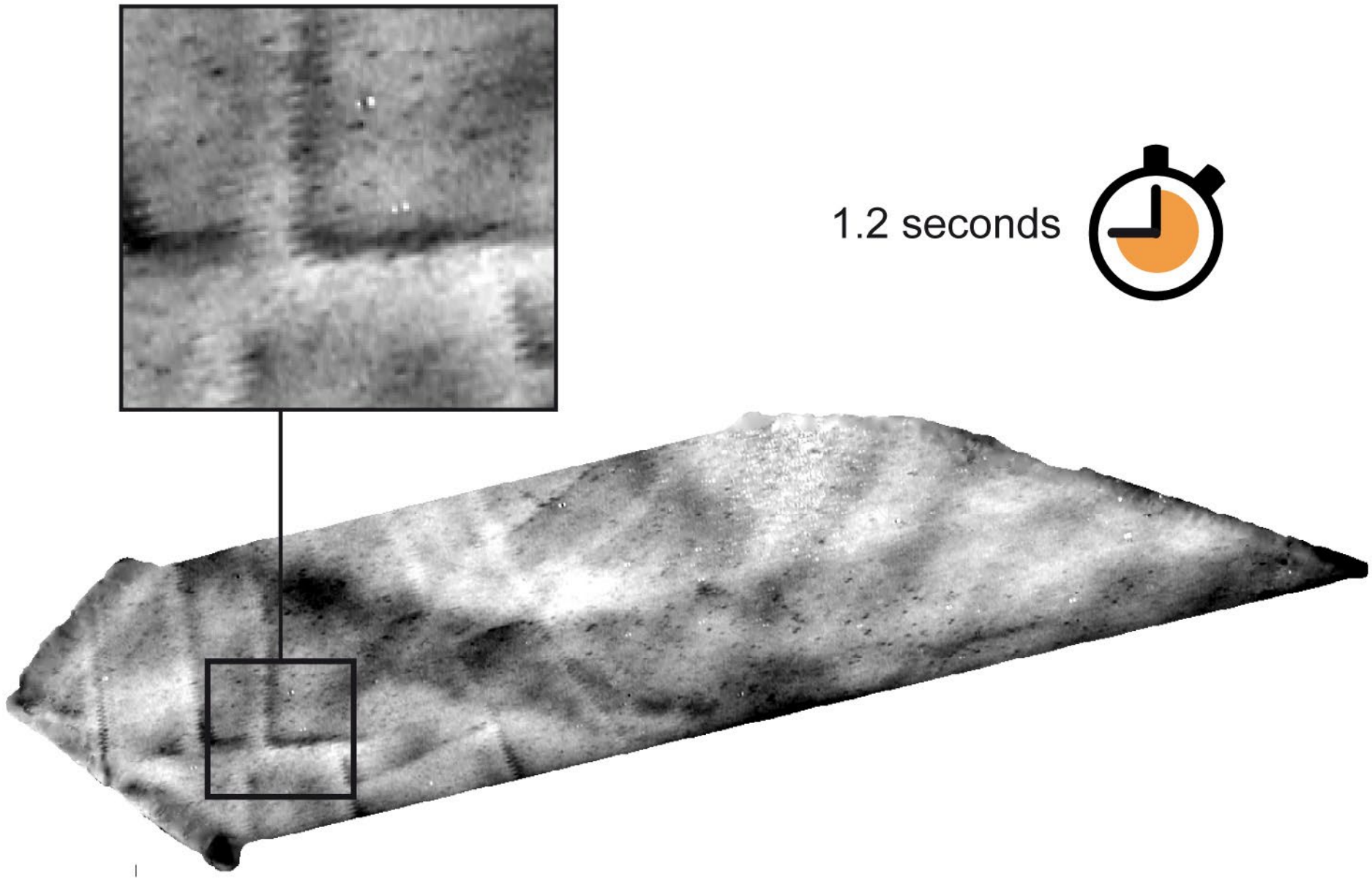
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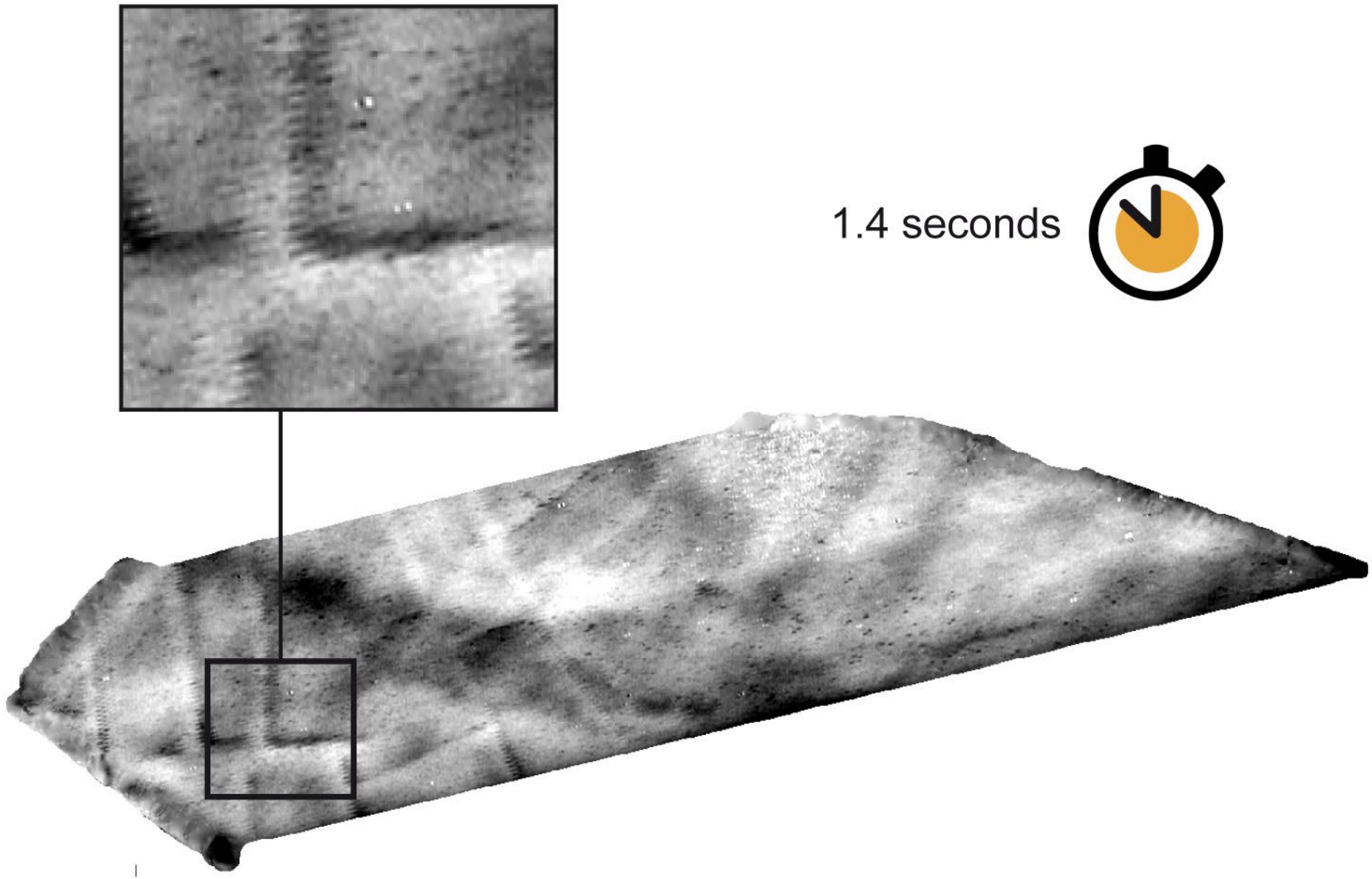
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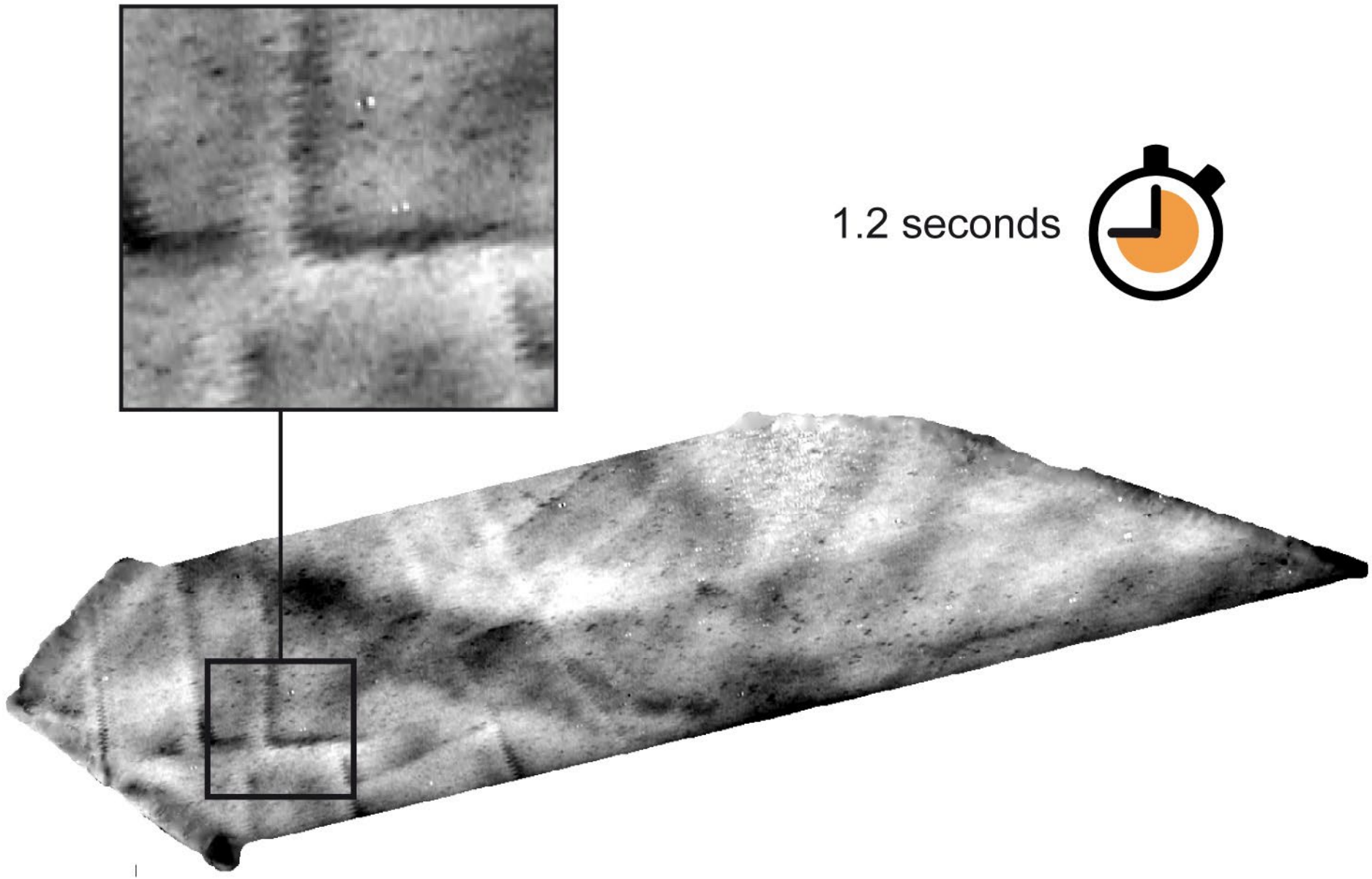
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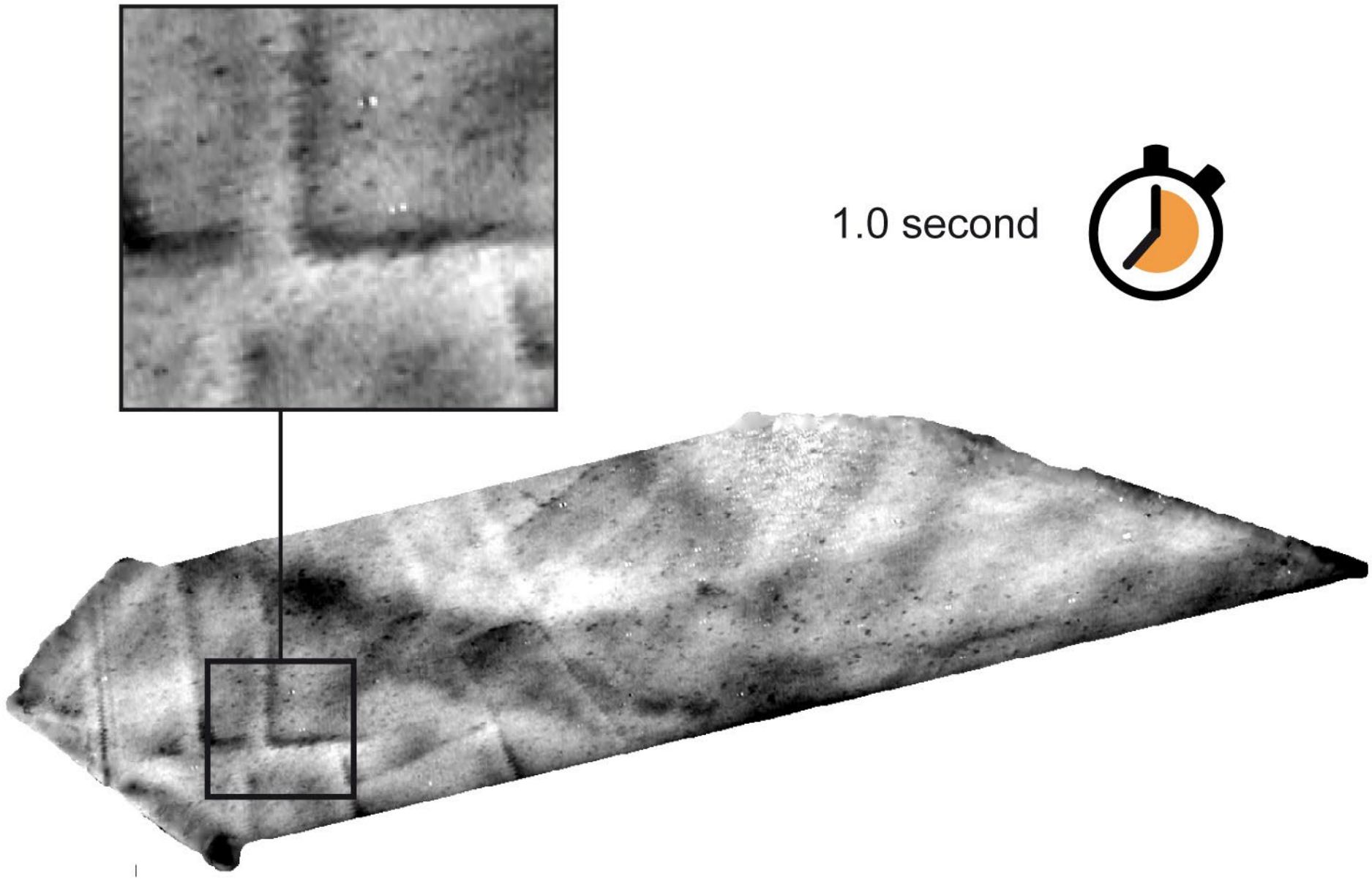
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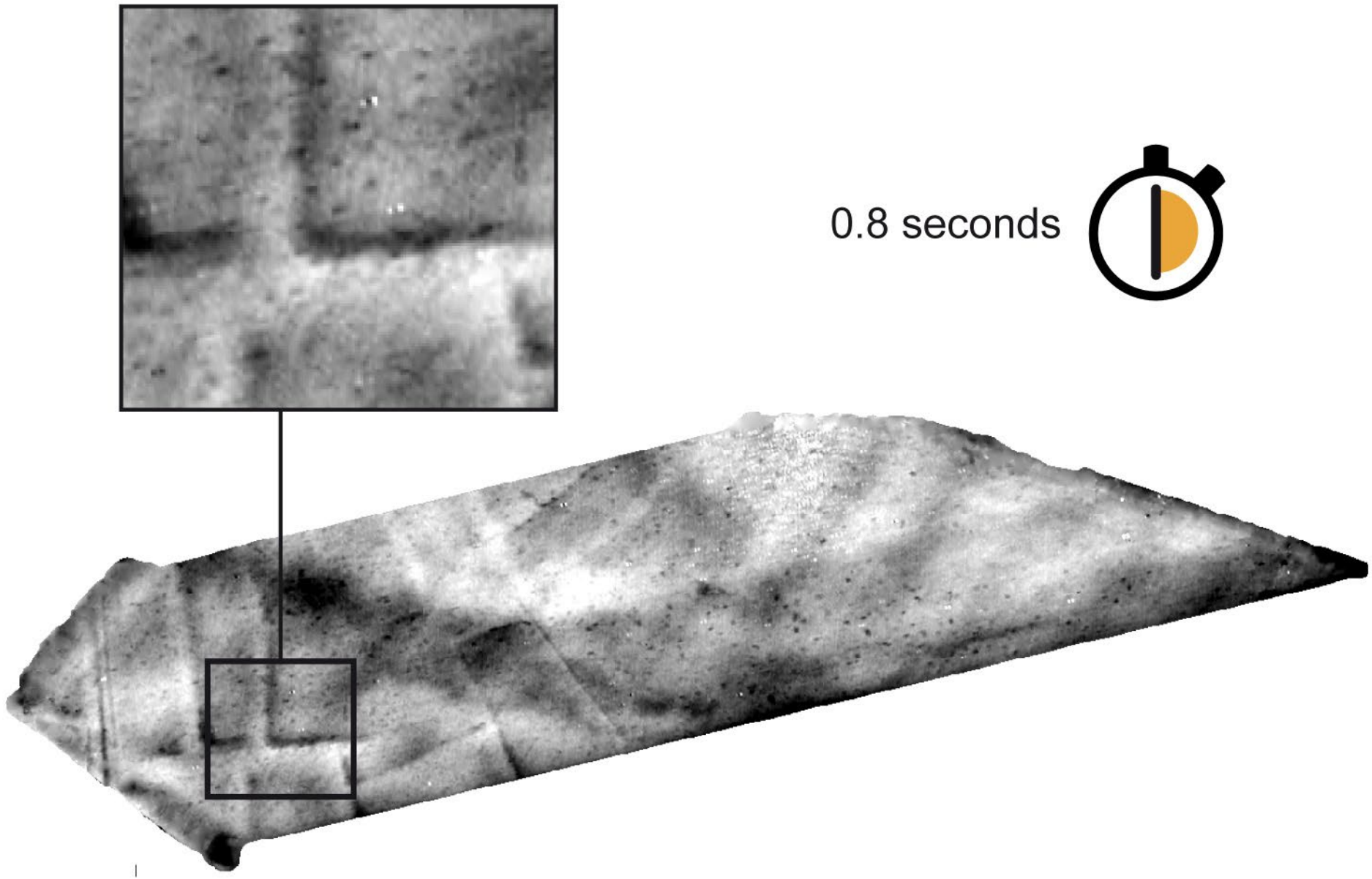
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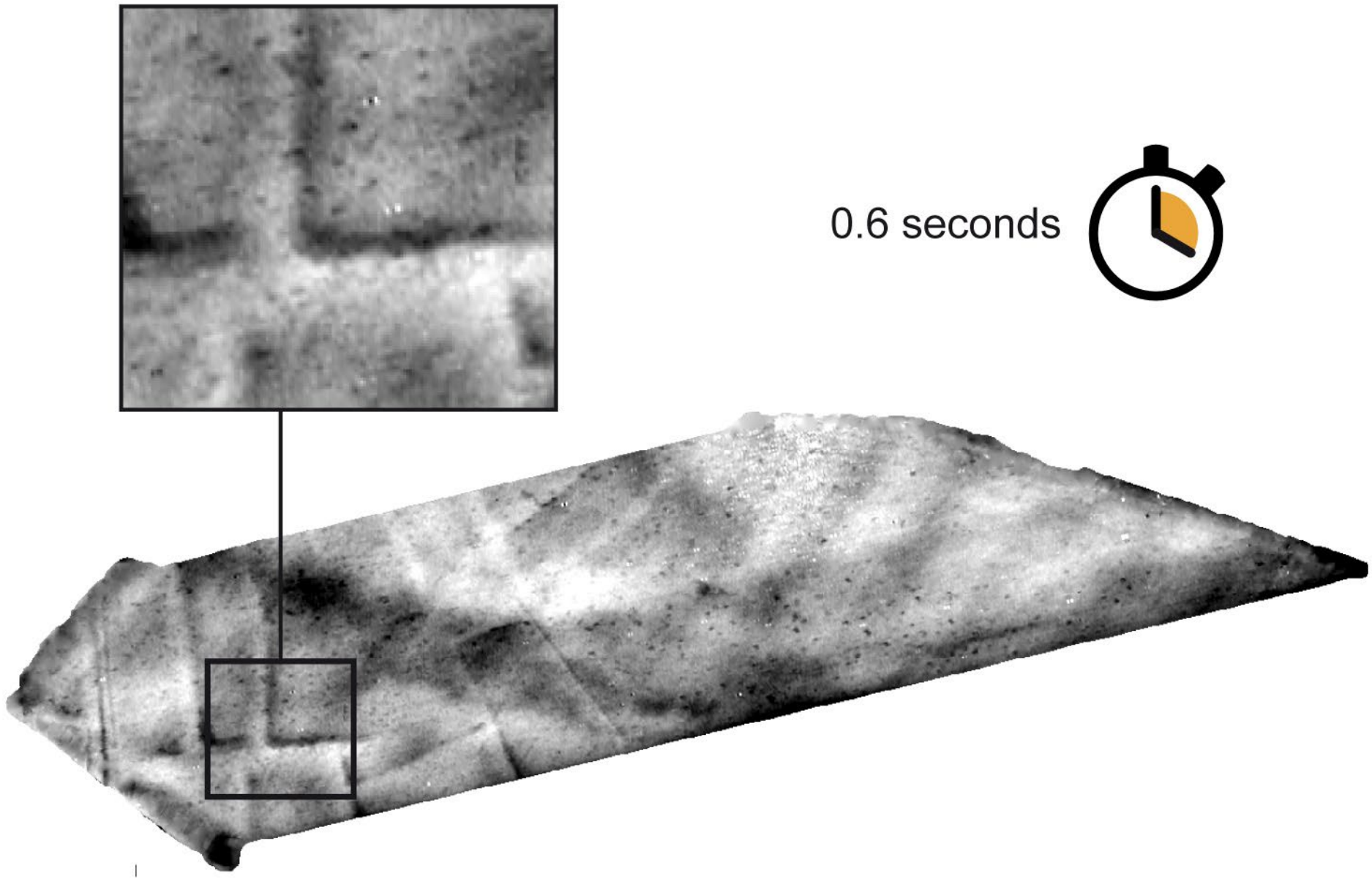
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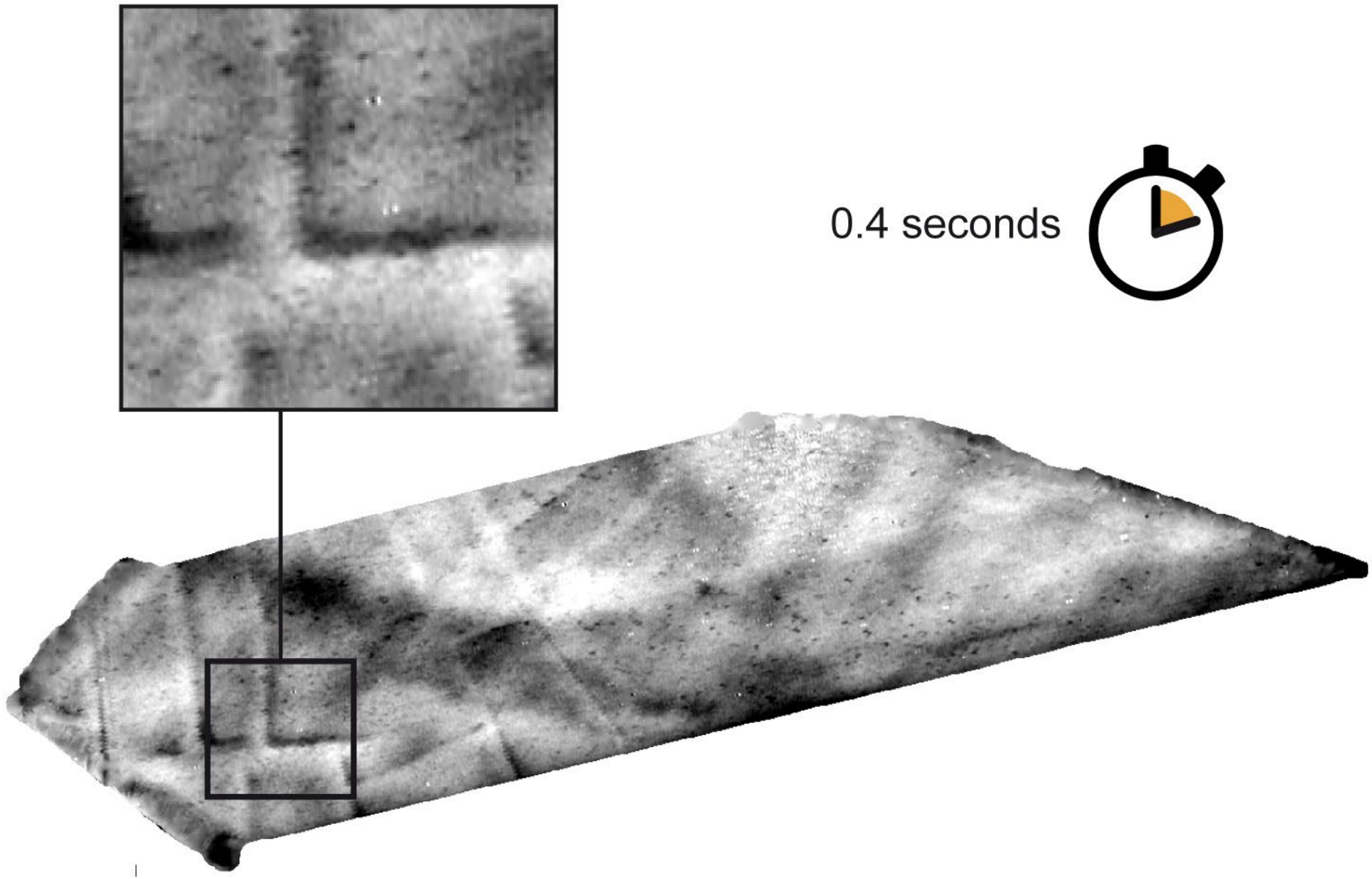
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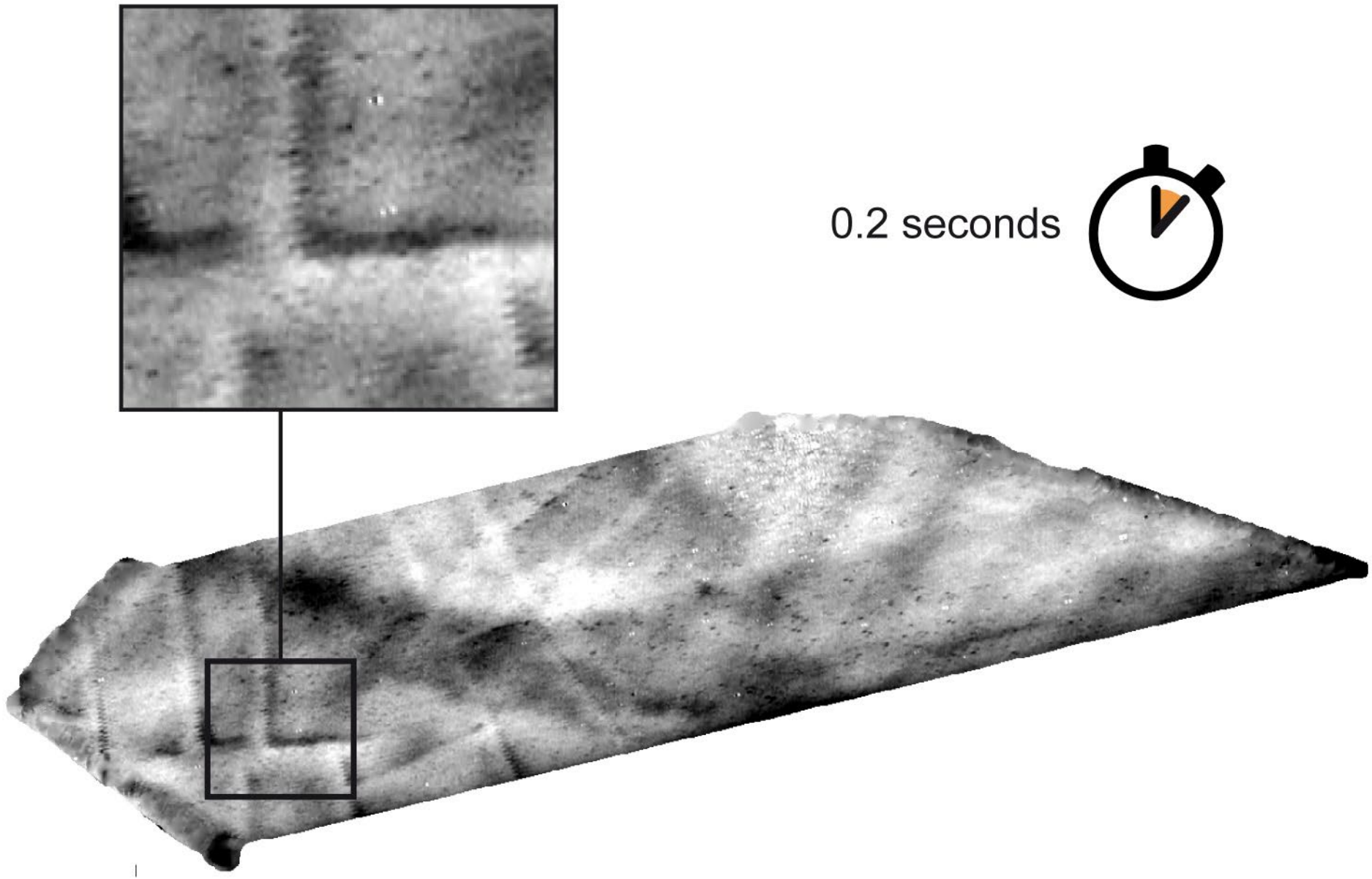
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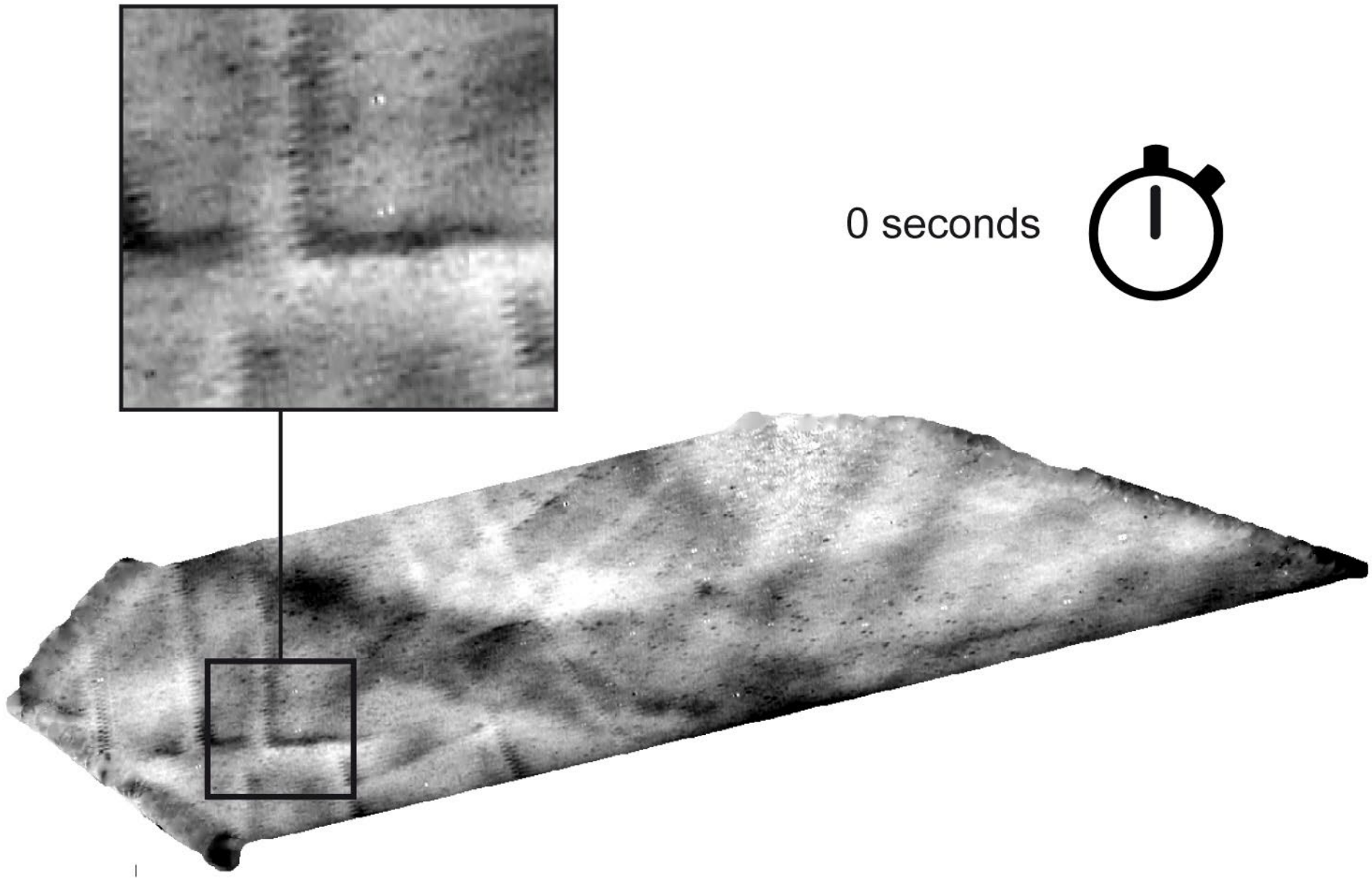
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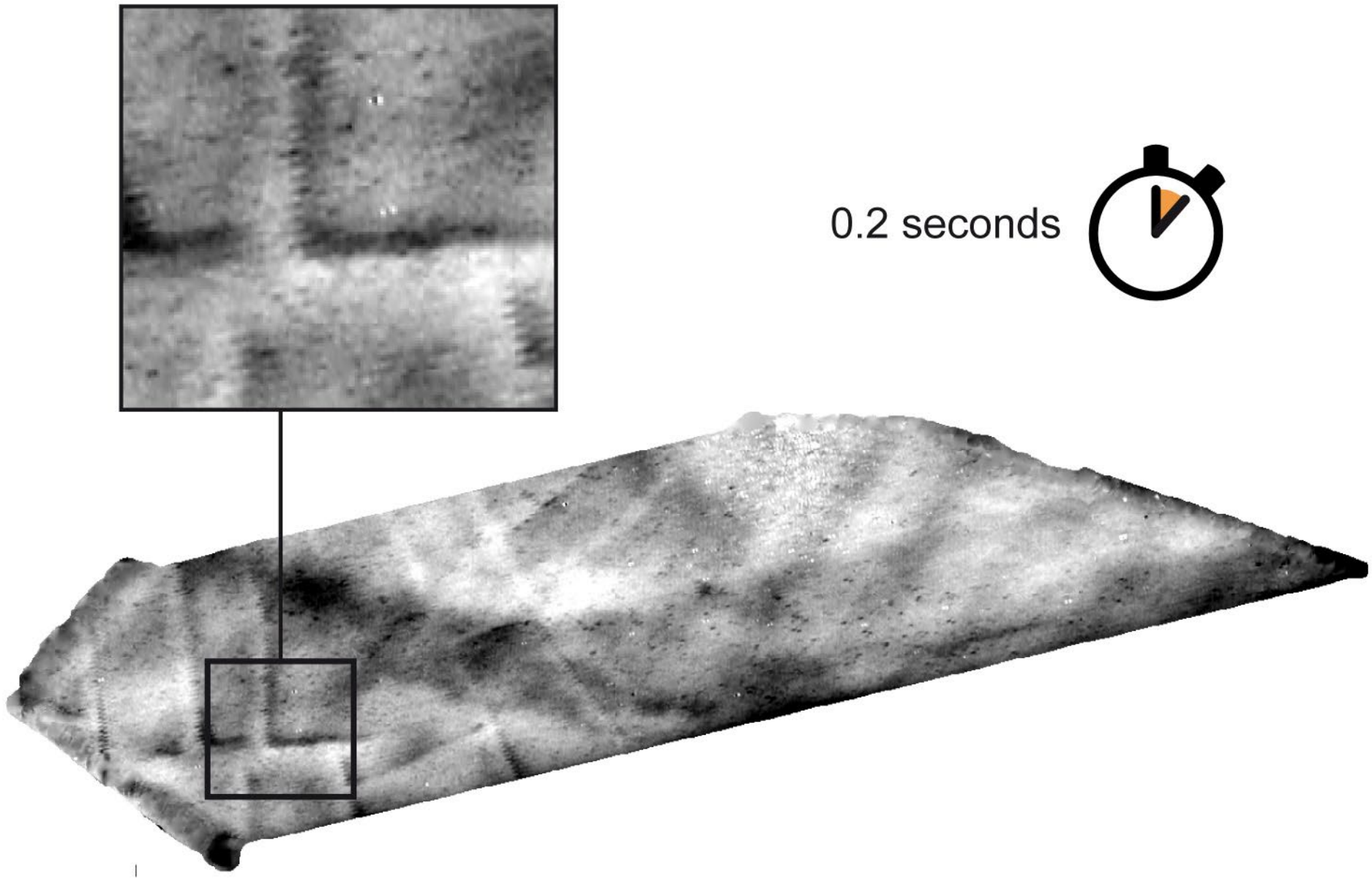
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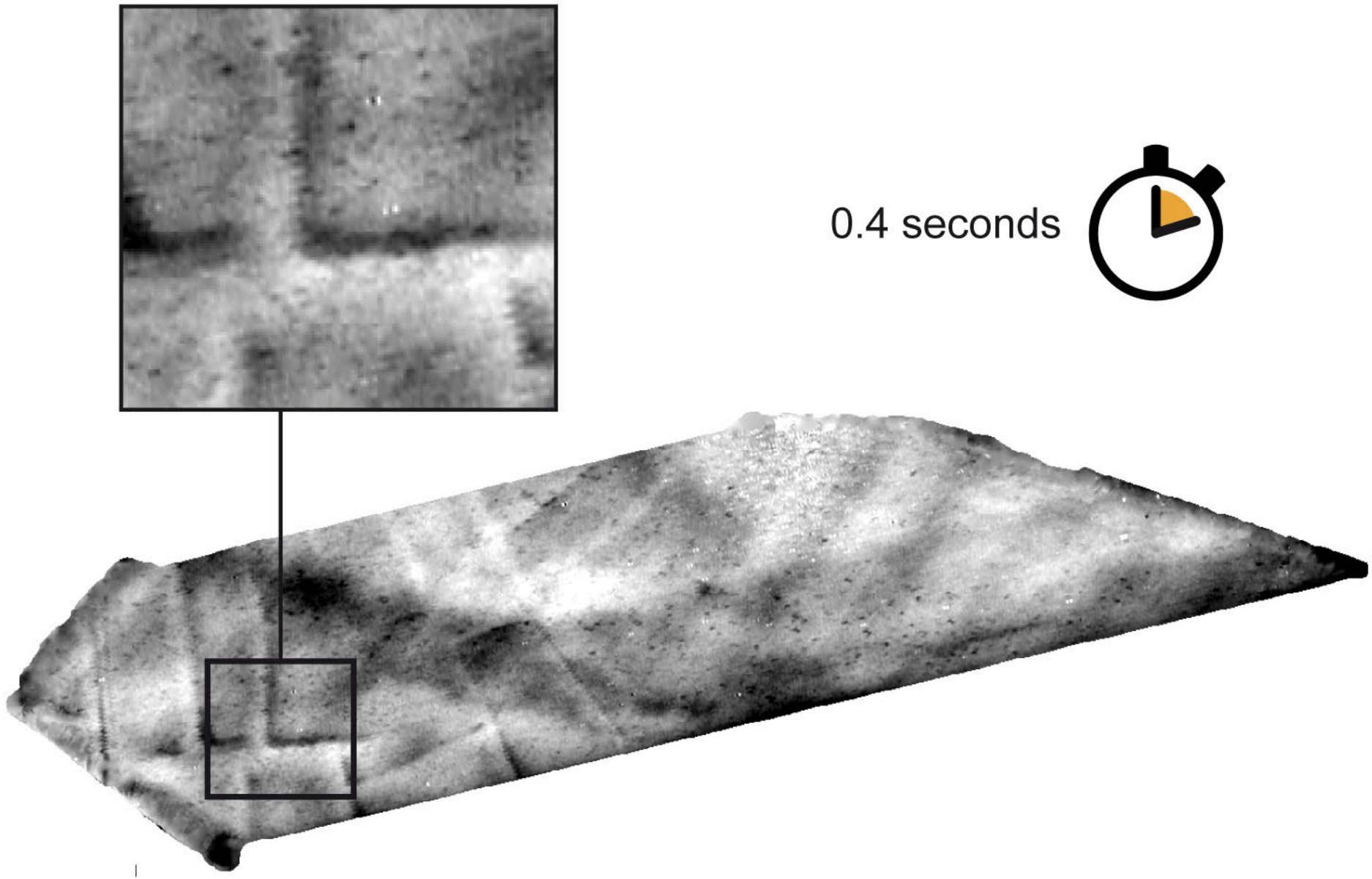
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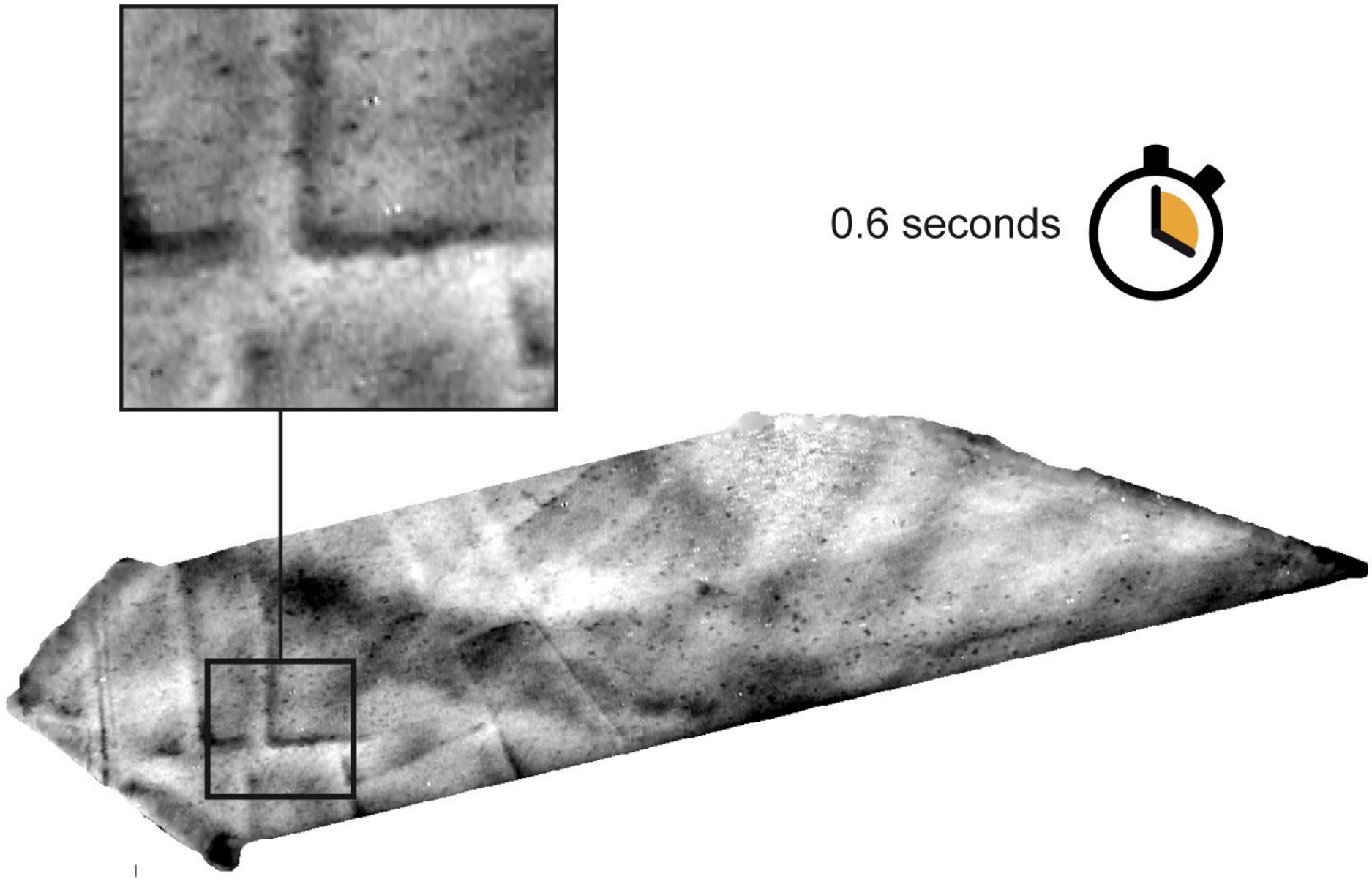
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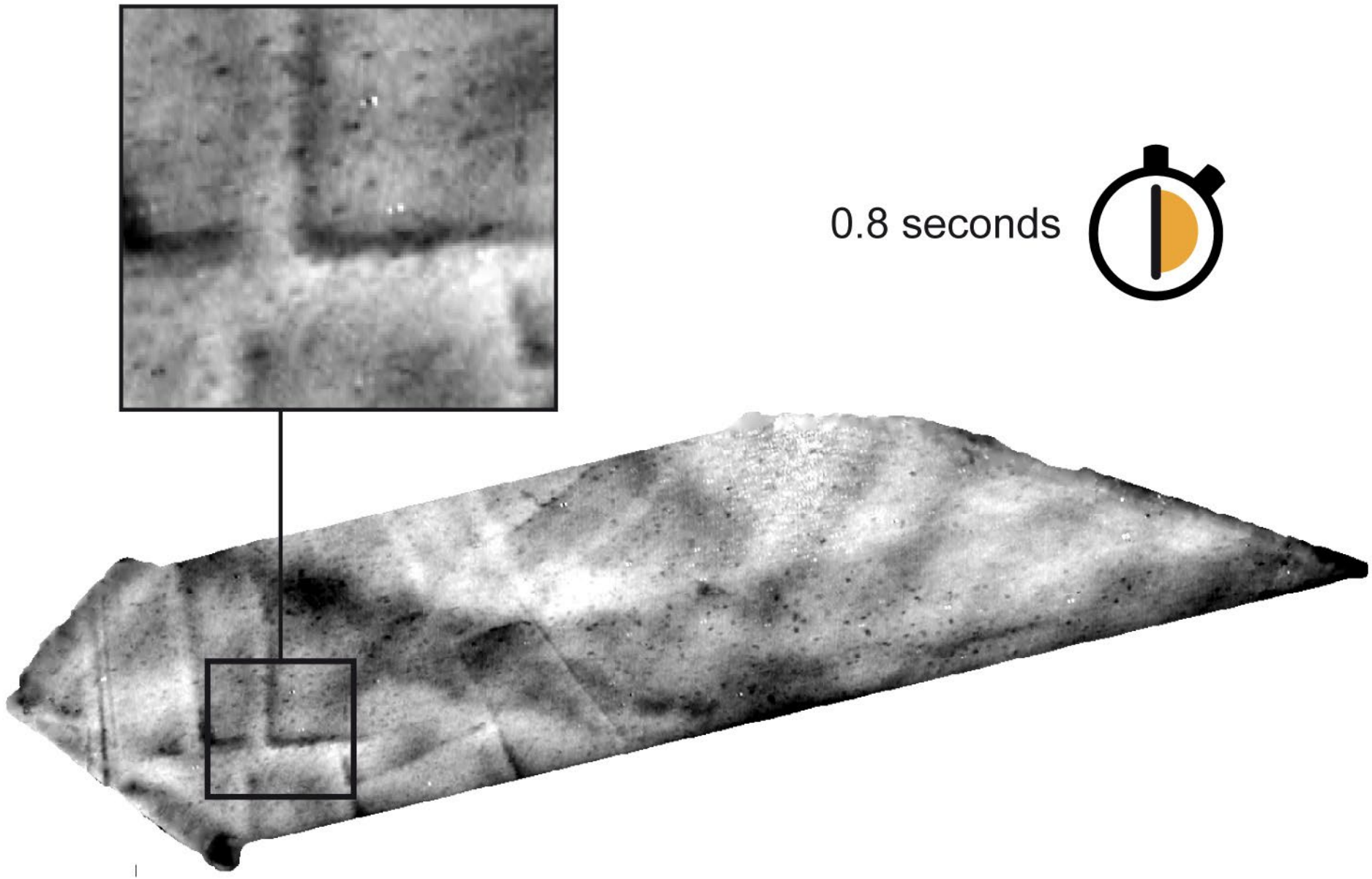
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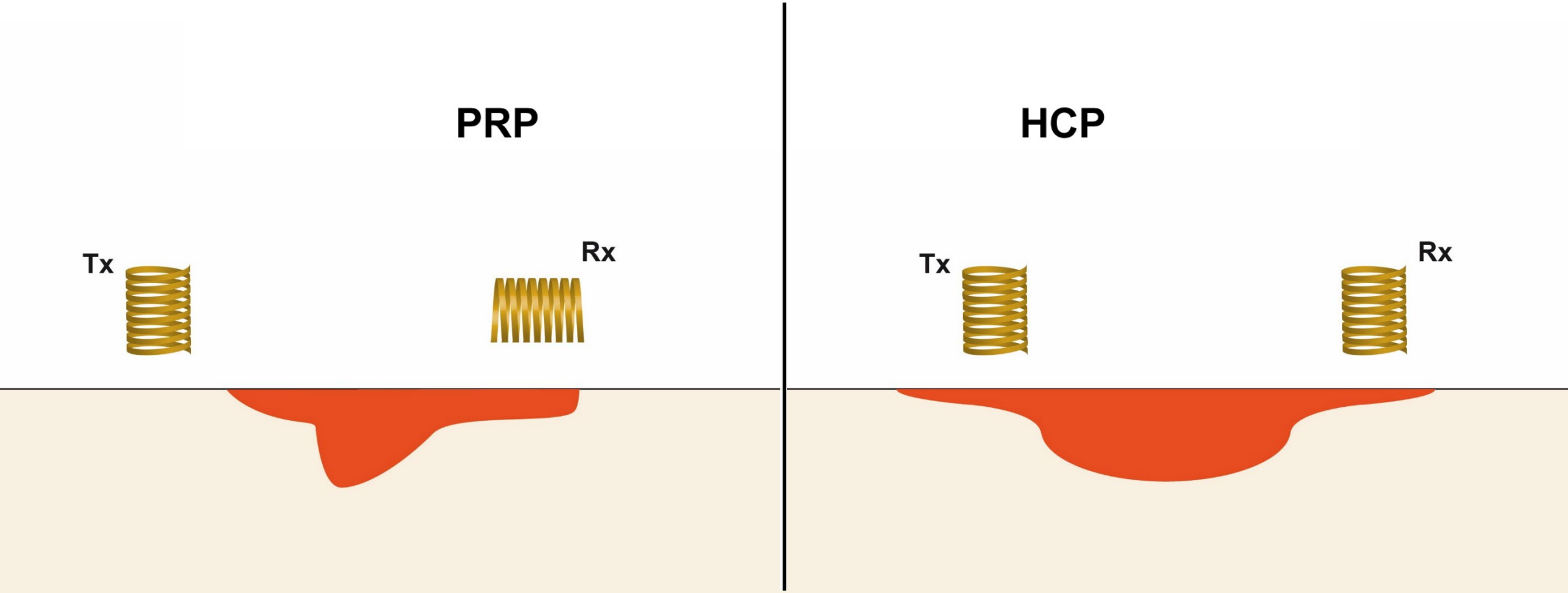
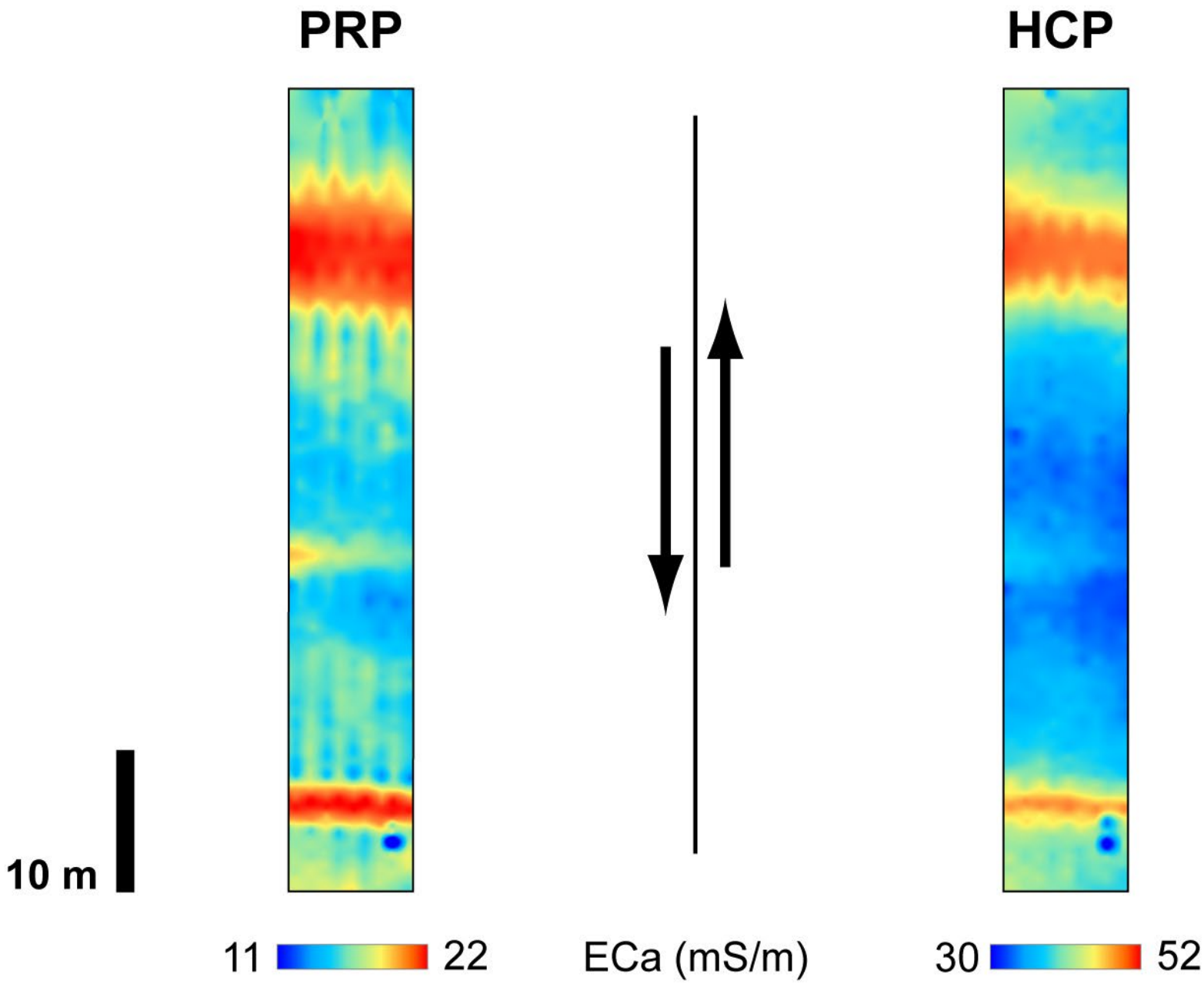
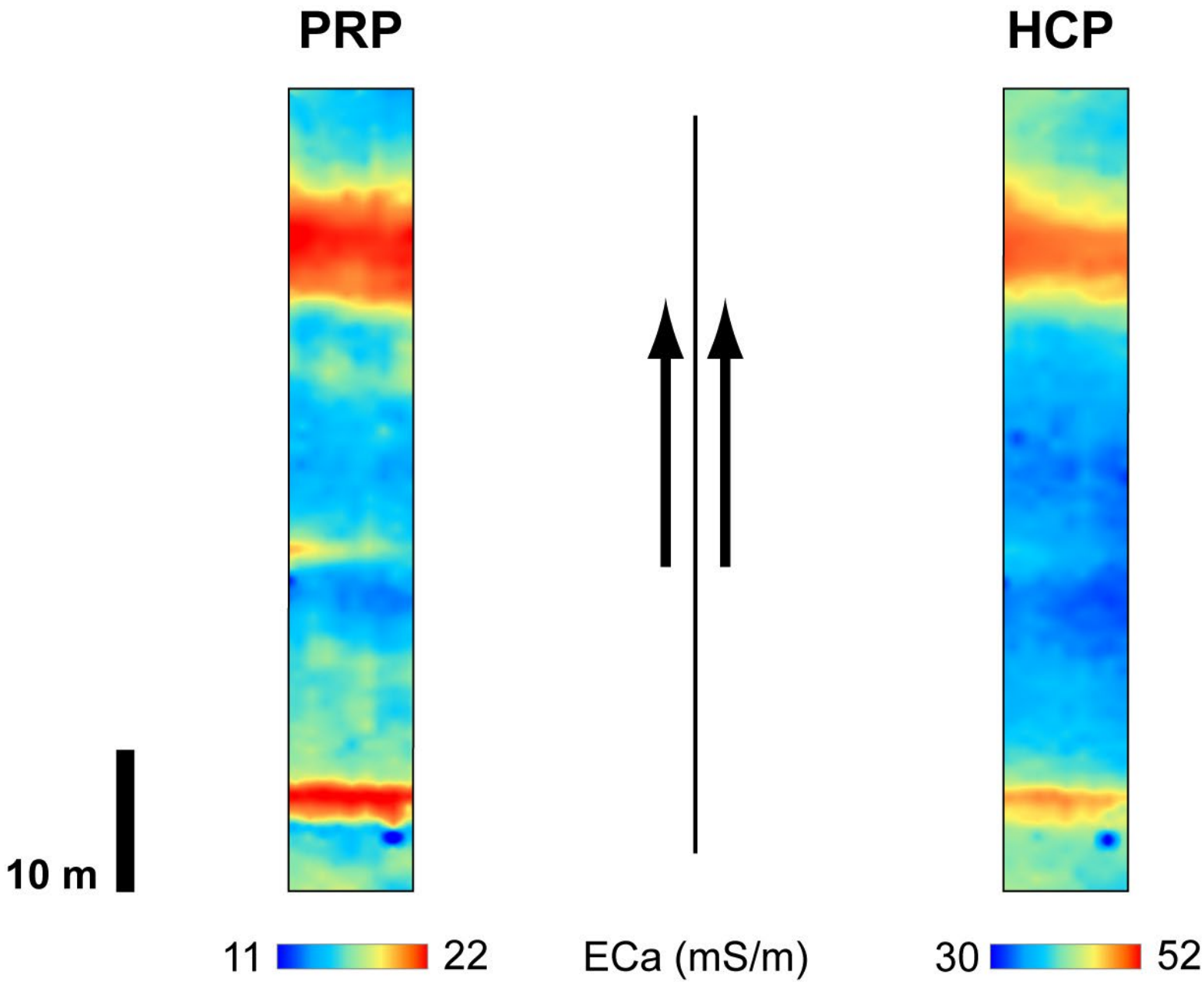
Anisotropy (directional dependence) of coil geometries




PRP
HCP
10 m
11
22
ECa (mS/m)
30
52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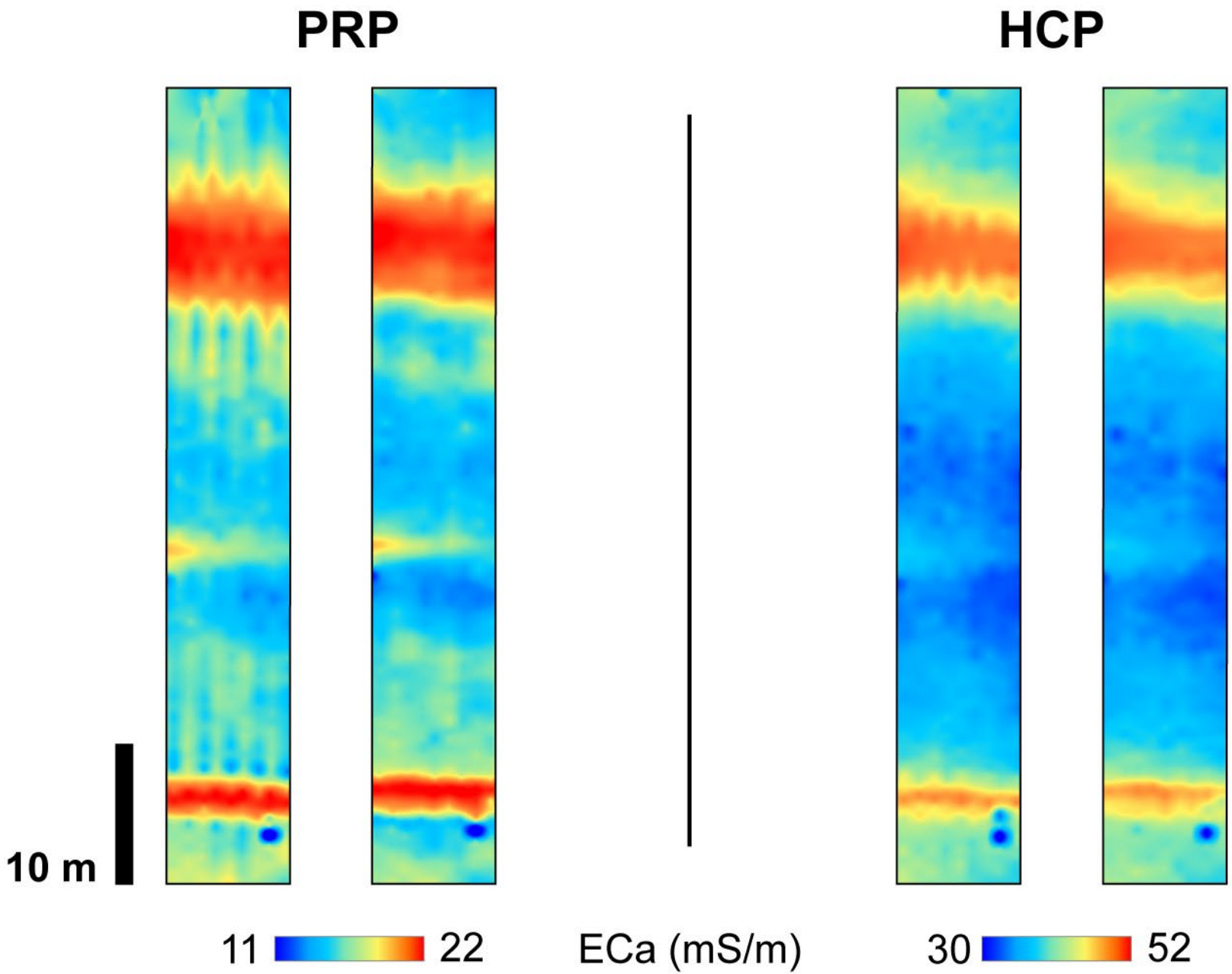
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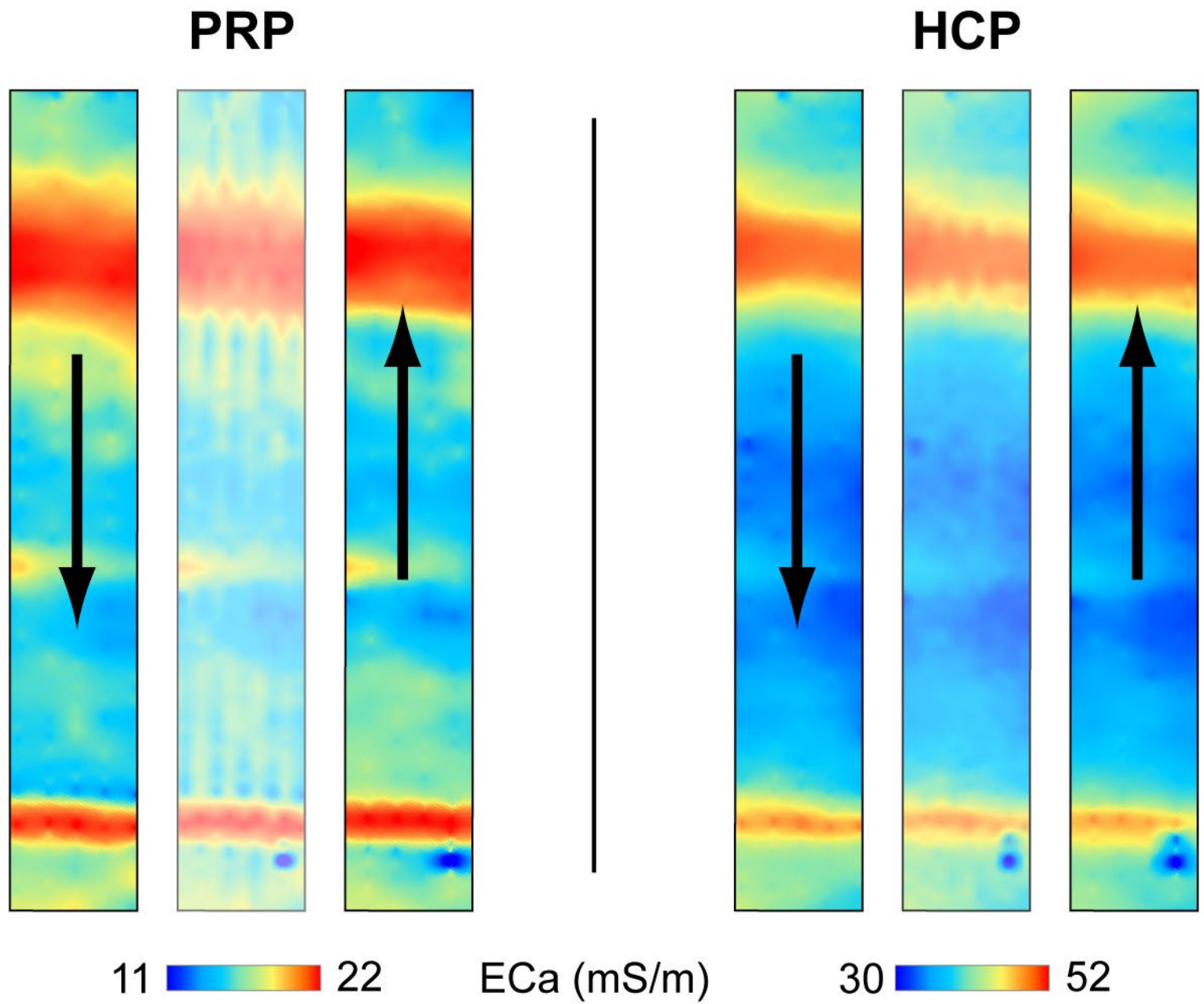
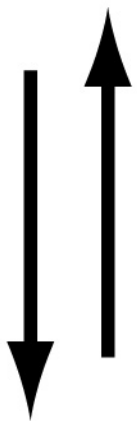

PRP
HCP
11
22
ECa (mS/m)
30
52

‘Staggering’

TIME-LAG

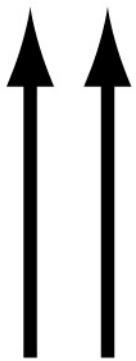
ORIENTATION



‘Staggering’

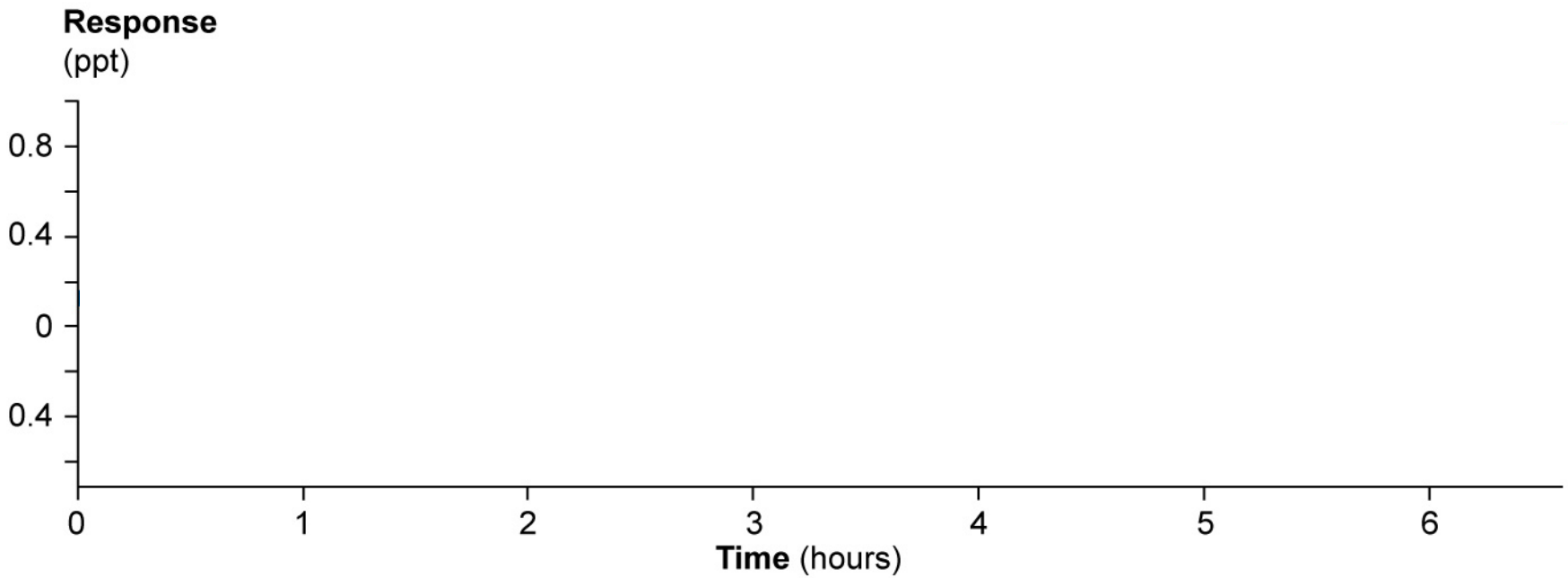
TIME-LAG

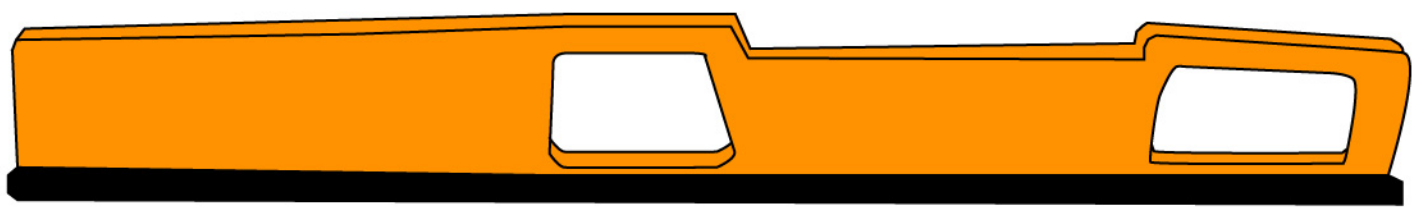
ORIENTATION

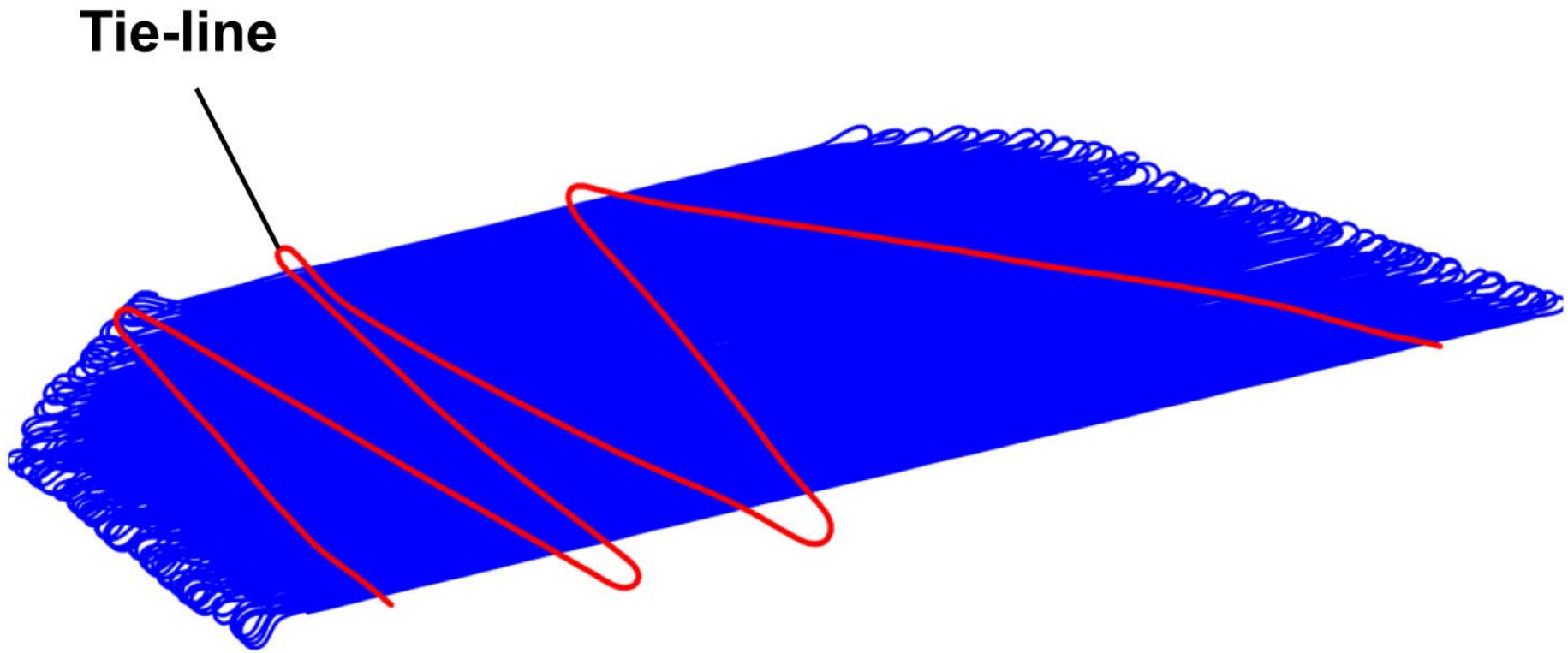


Problem 2: instrumental drift

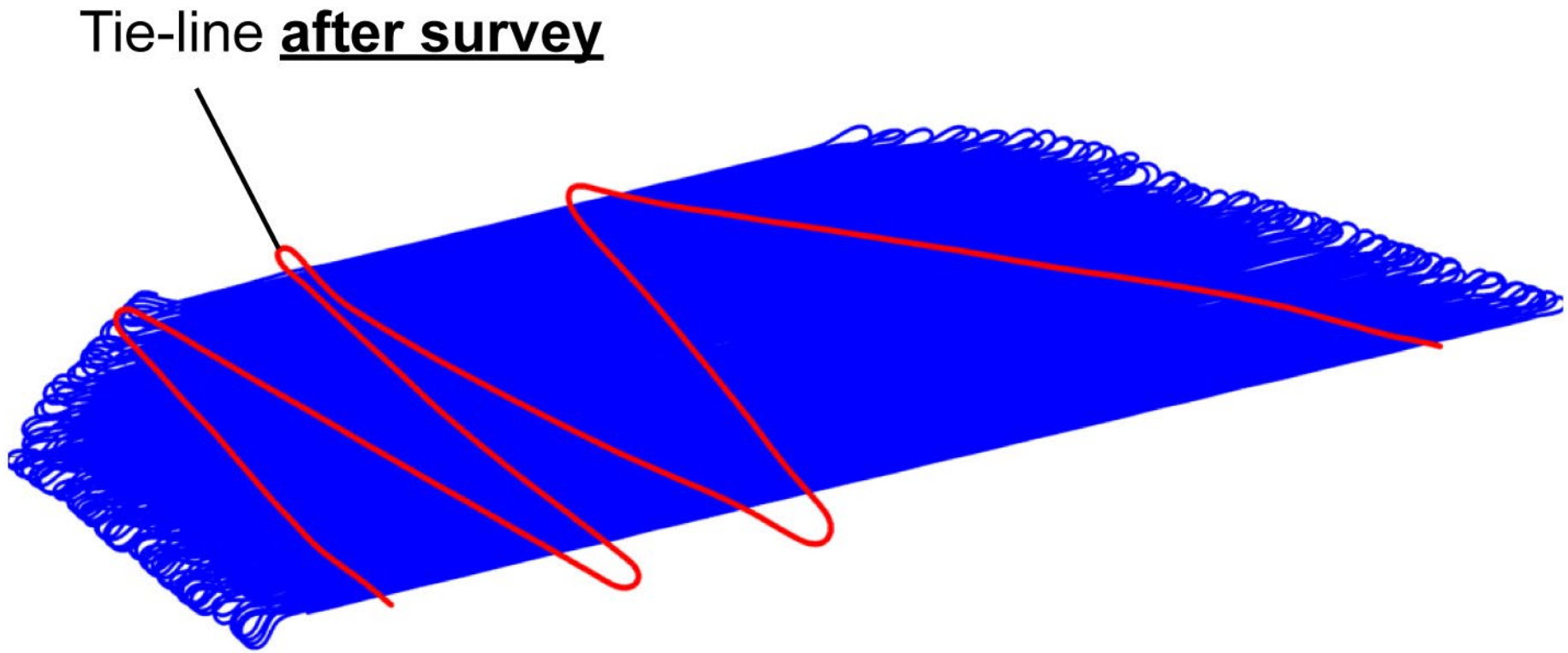
Drift





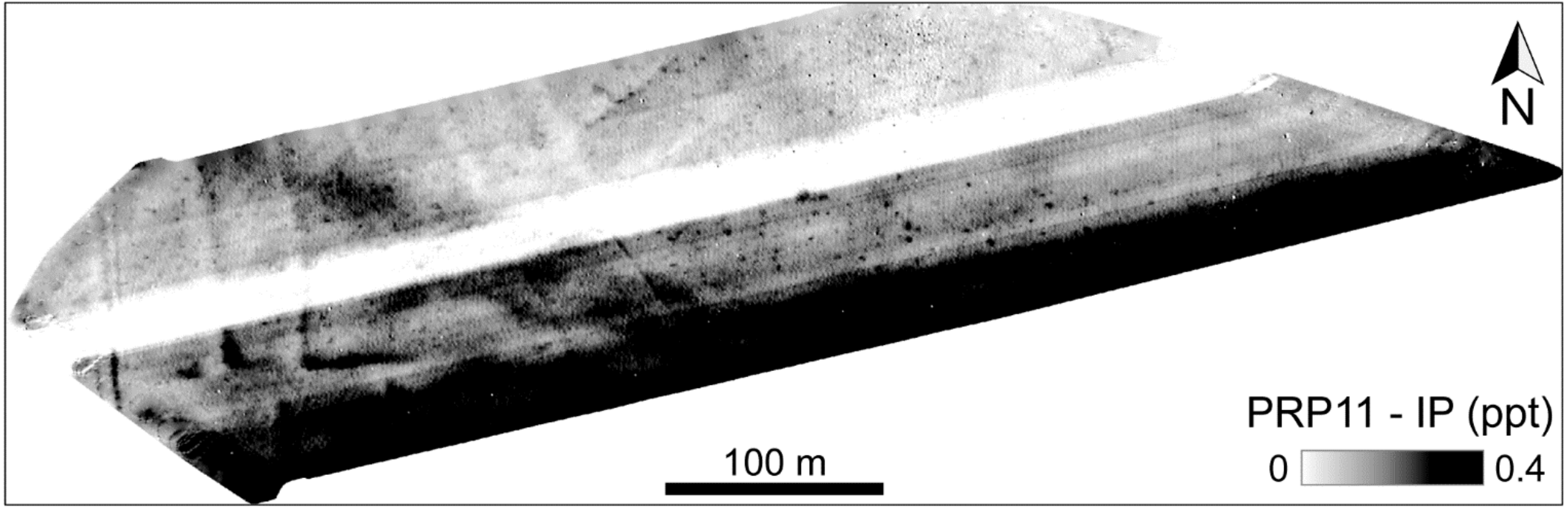


Delefortrie et al. 2014 - *J. Applied Geophysics*



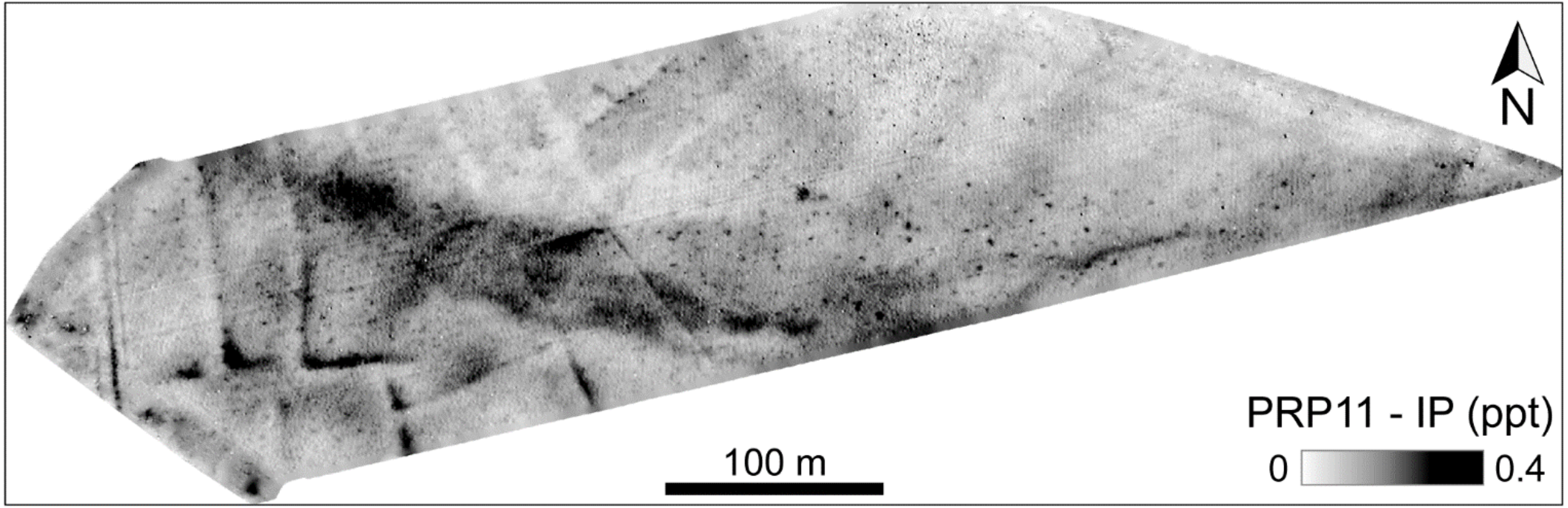
Delefortrie et al. 2014 - *J. Applied Geophysics*

Original data



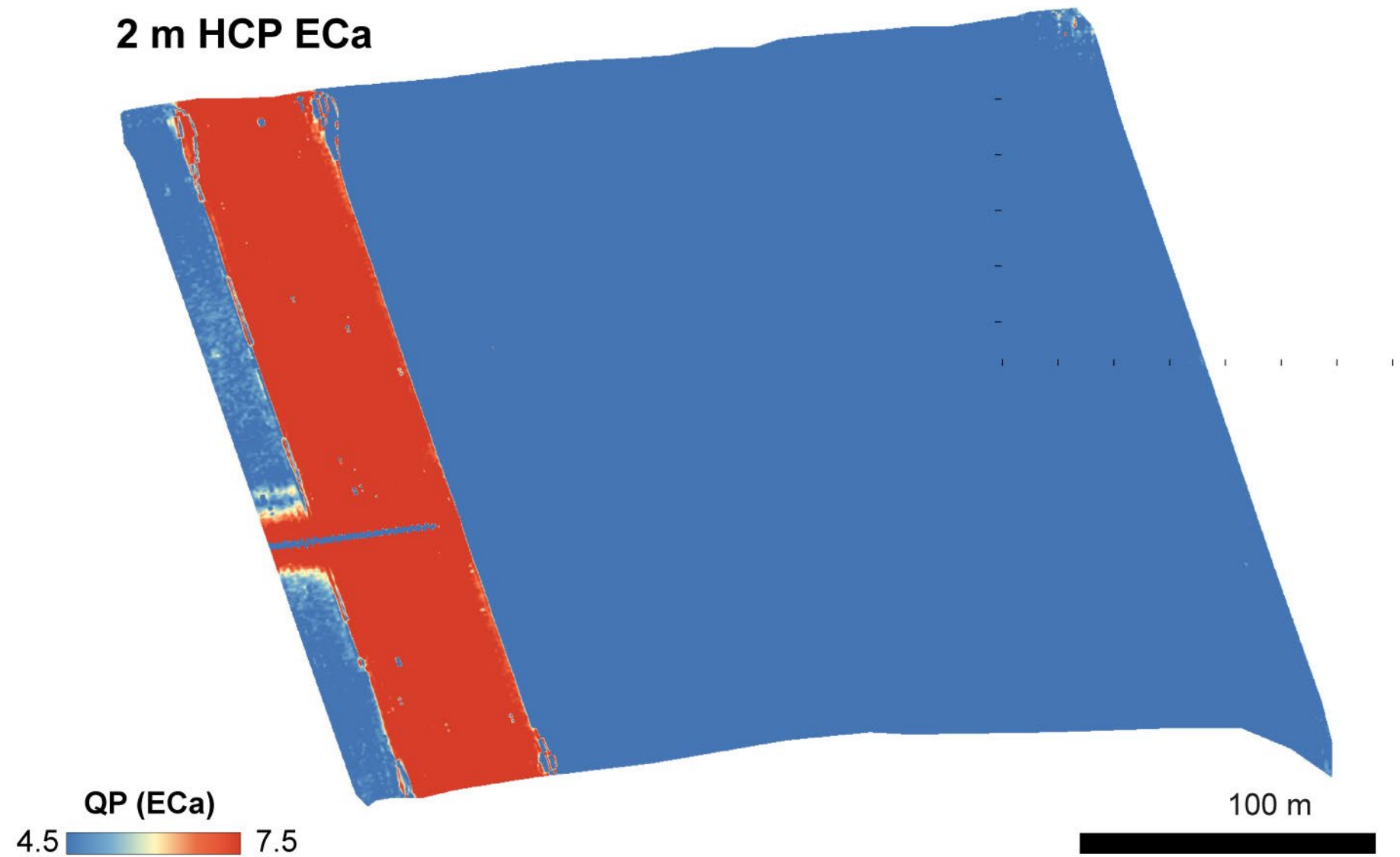
Delefortrie et al. 2014

Drift-corrected data

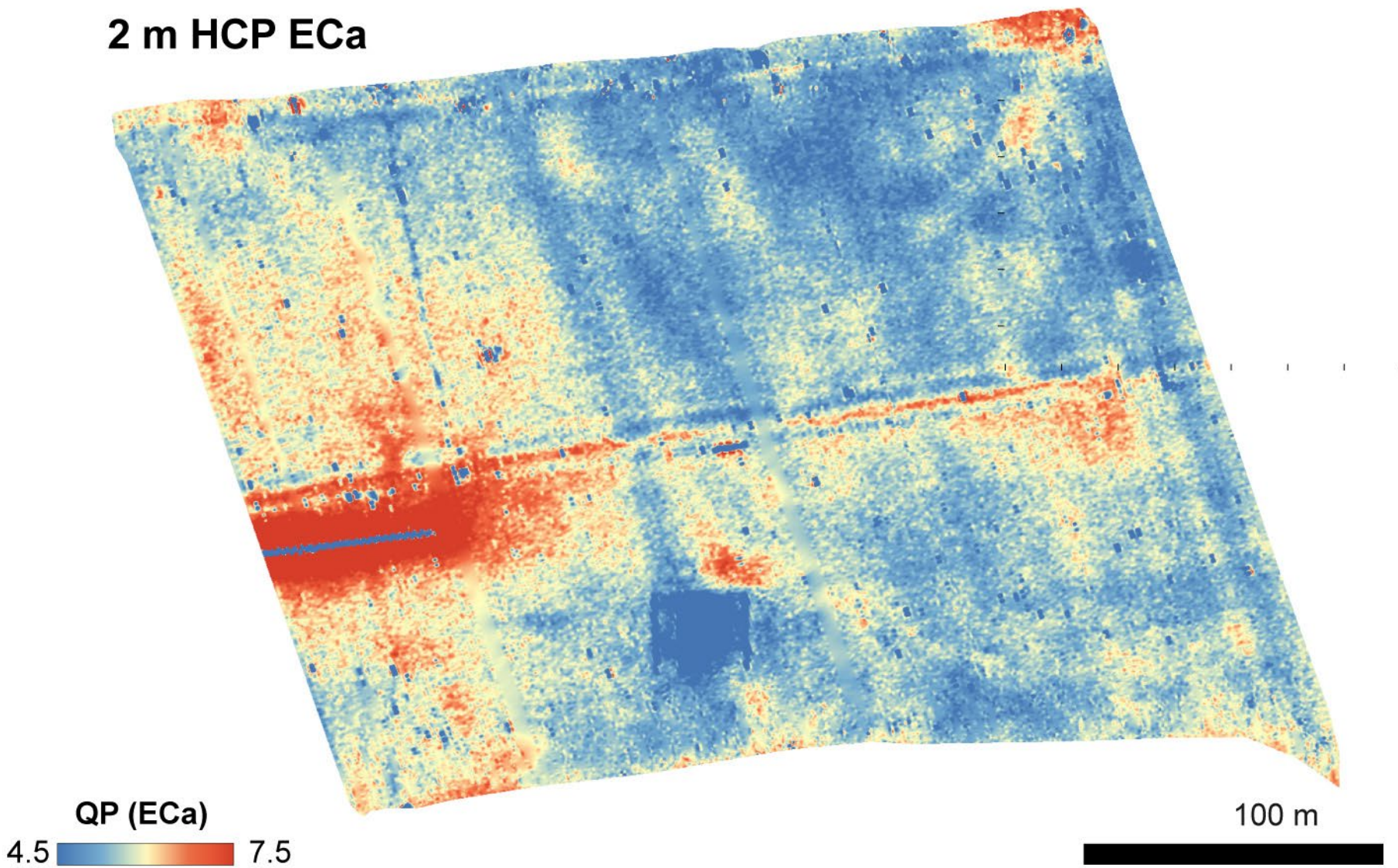


Delefortrie et al. 2014

Baseline drift

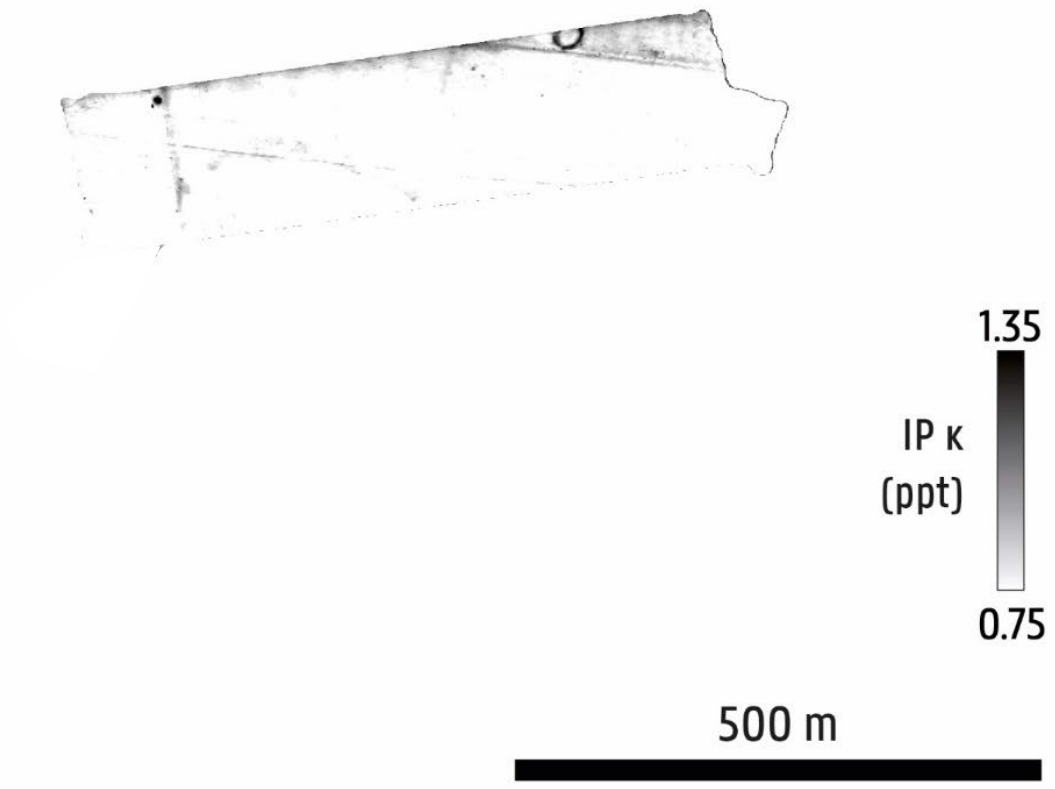


Baseline drift



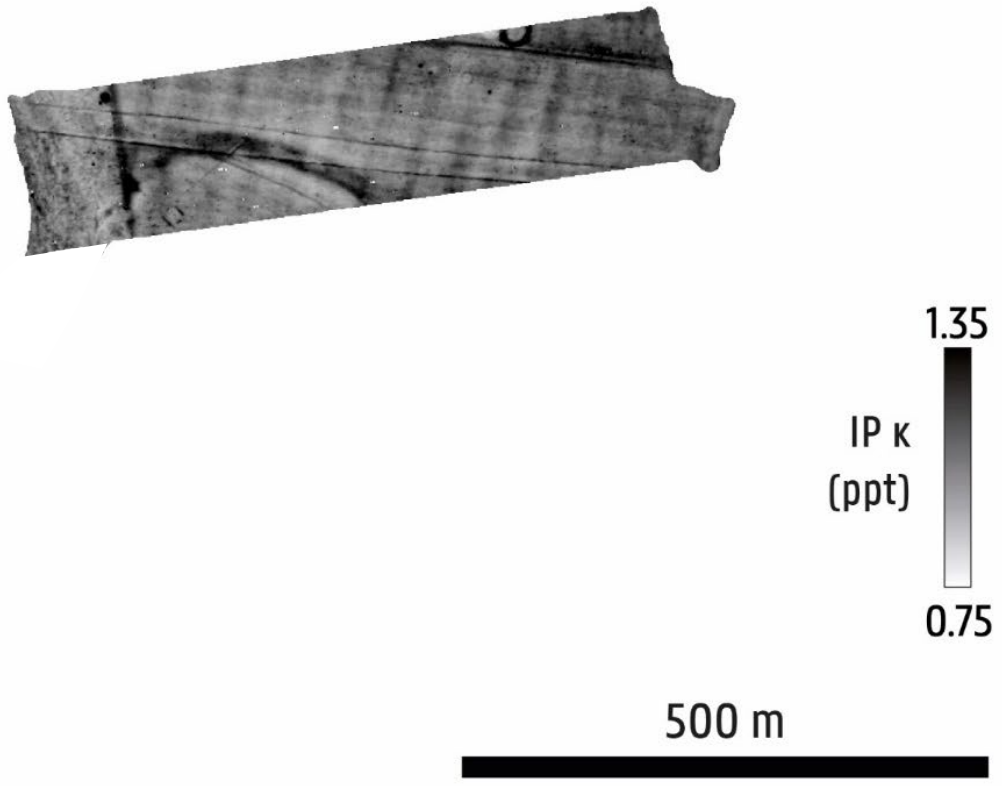
Problem 2.1: offsets between survey days

Raw data for 1 survey day



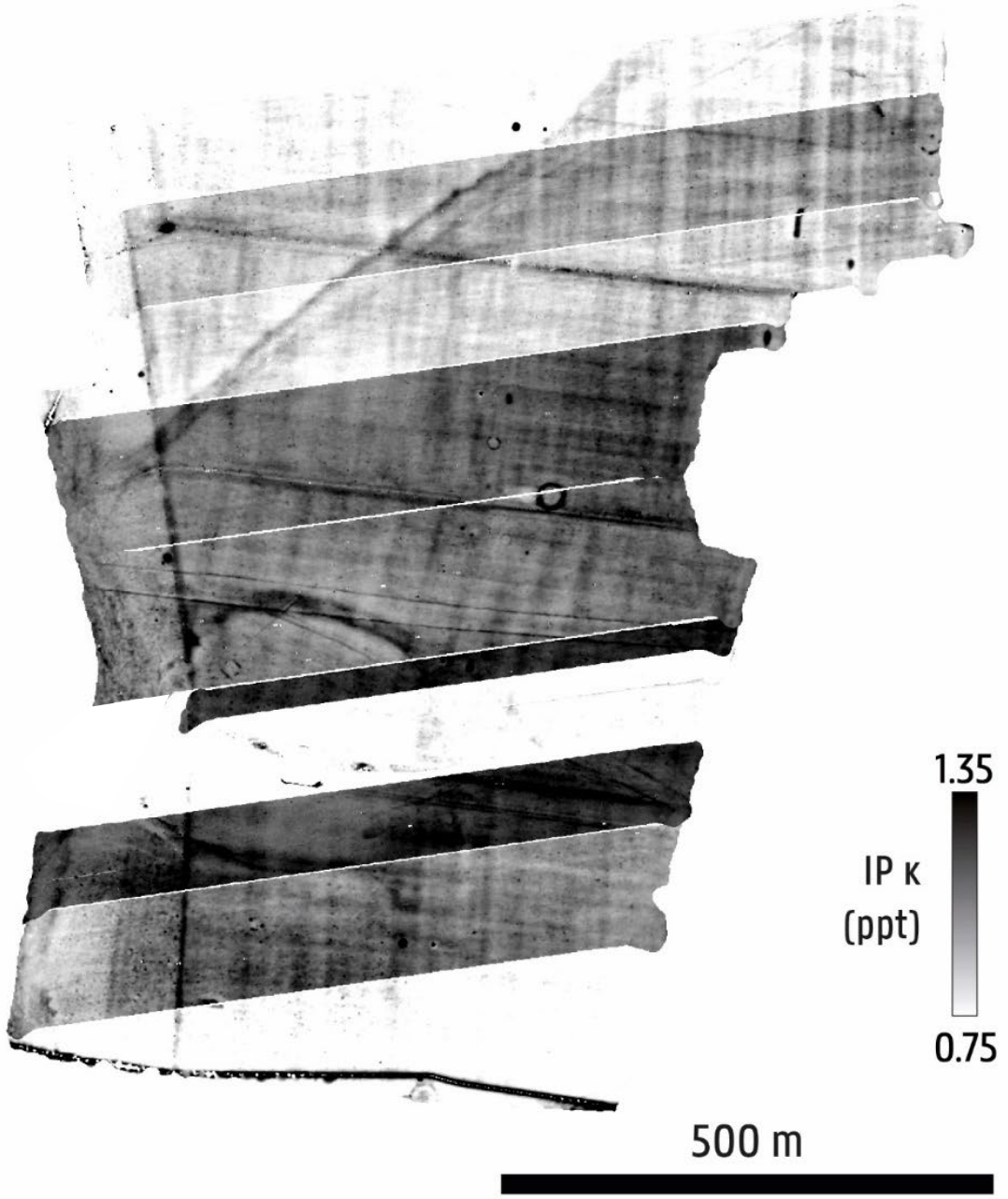
Problem 2.1: offsets between survey days

Drift corrected data for 1 survey day



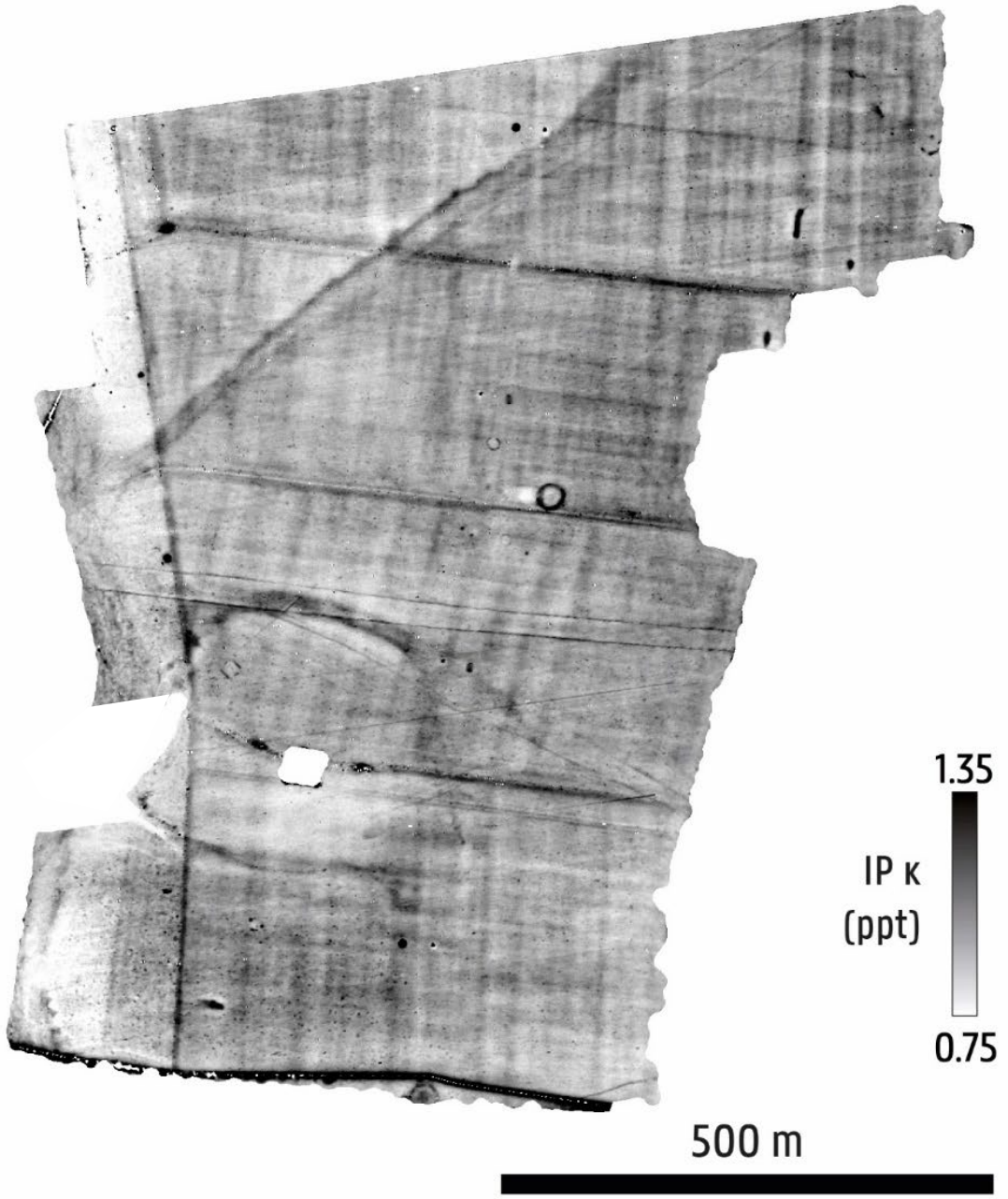
Problem 2.1: offsets between survey days

Drift corrected data for 10 survey days

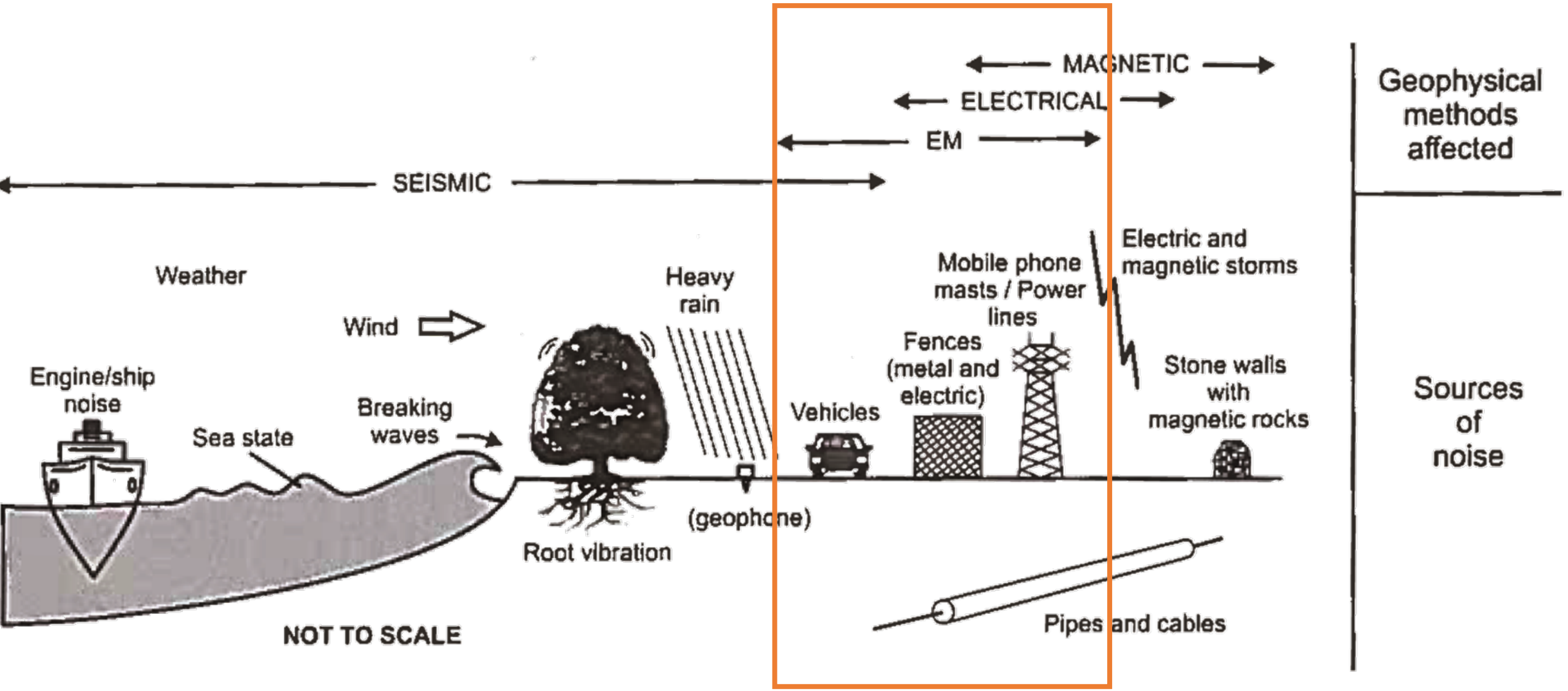


Problem 2.1: offsets between survey days

Levelled data for 10 survey days

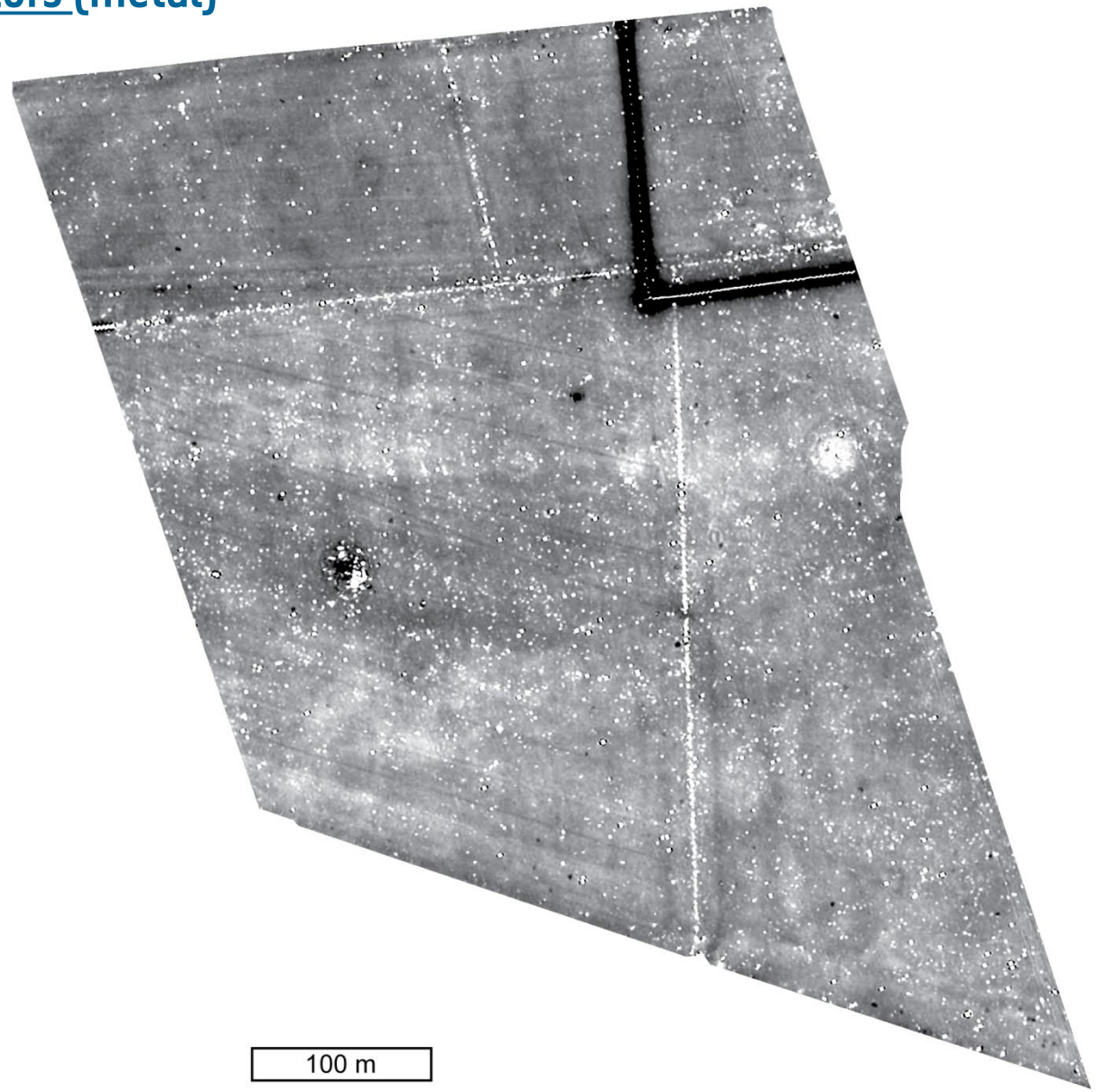


Problem 3: dealing with sources of noise

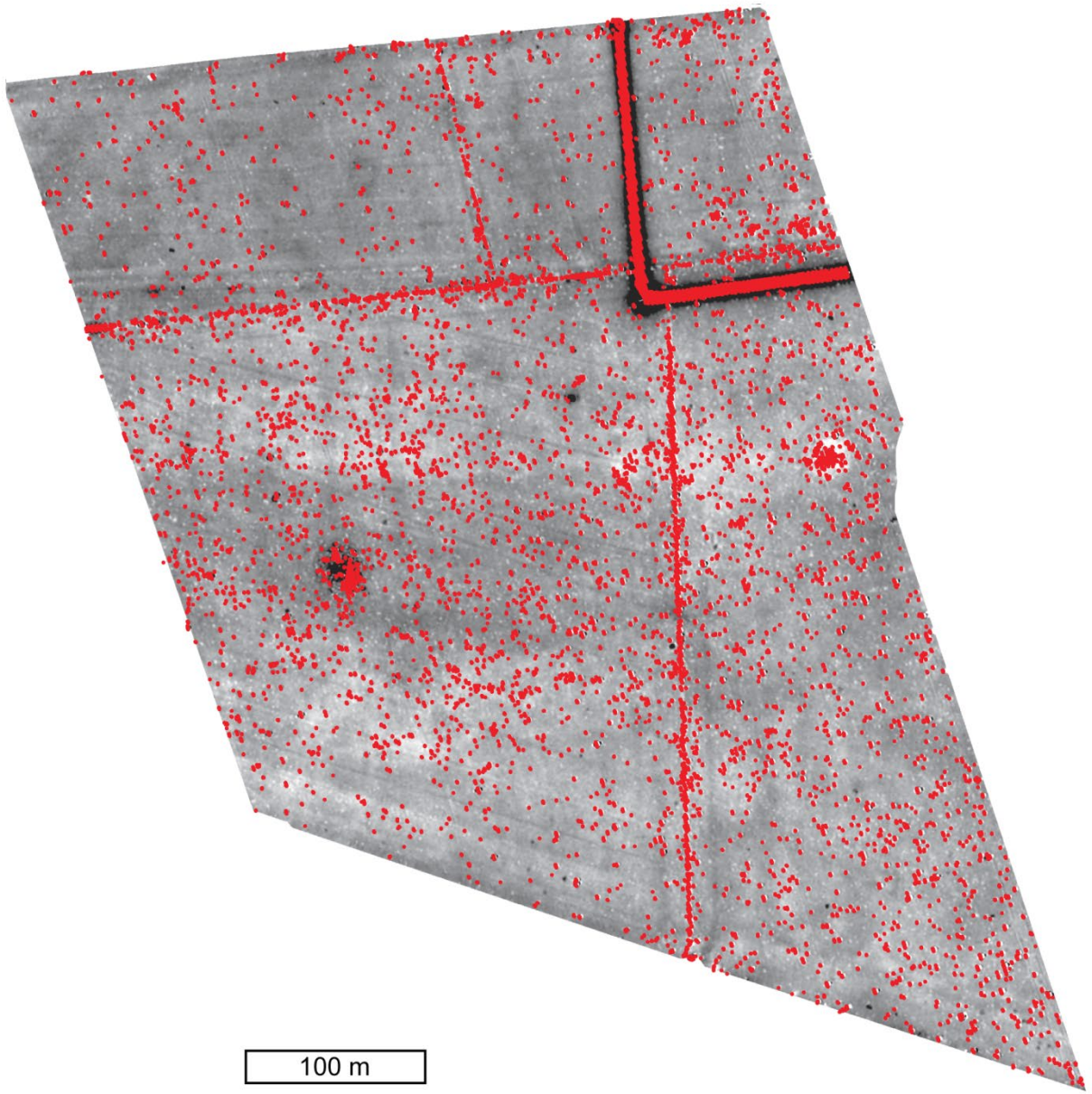


Most common: strong conductors (metal)

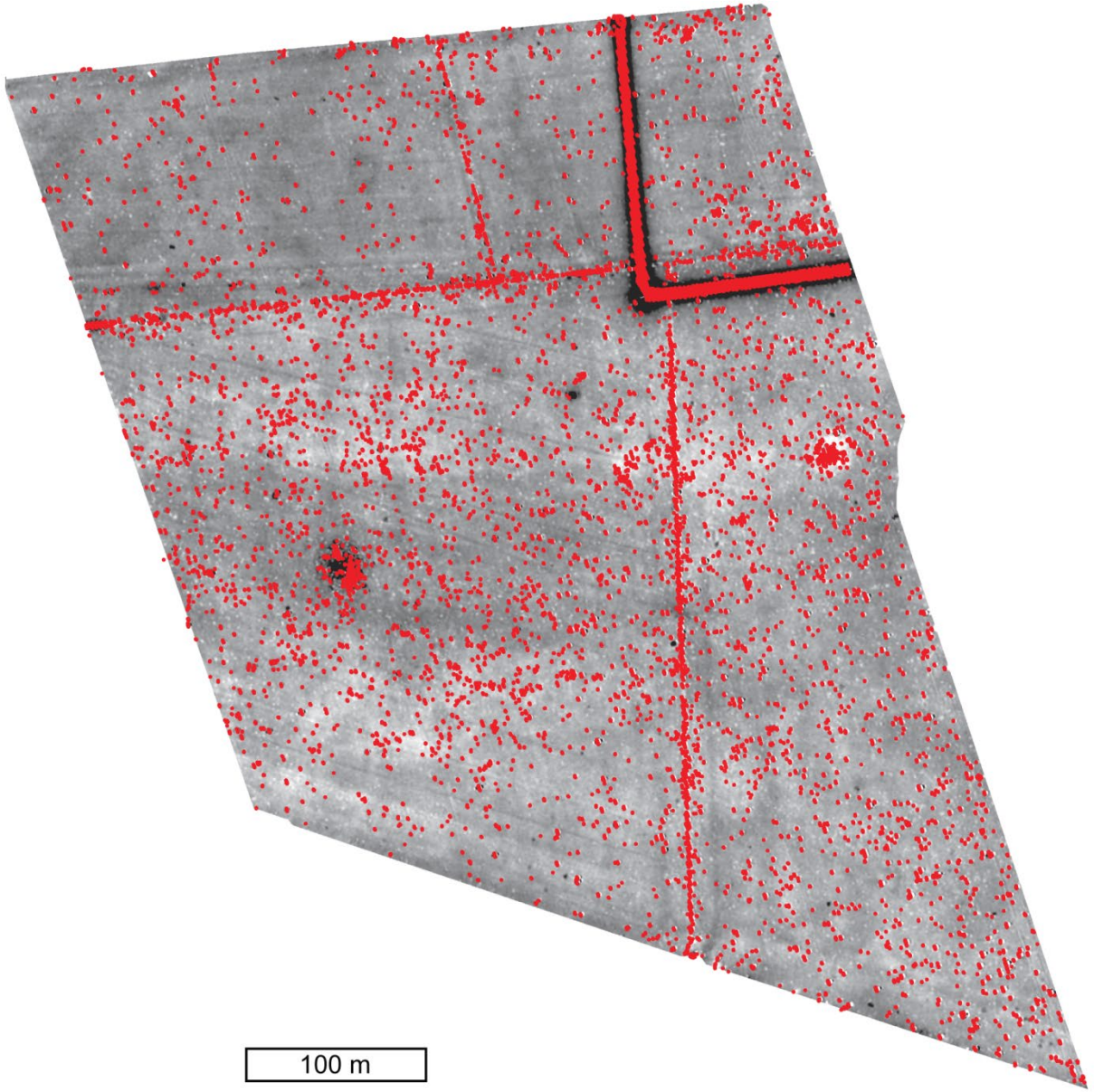
1 m HCP ECa data



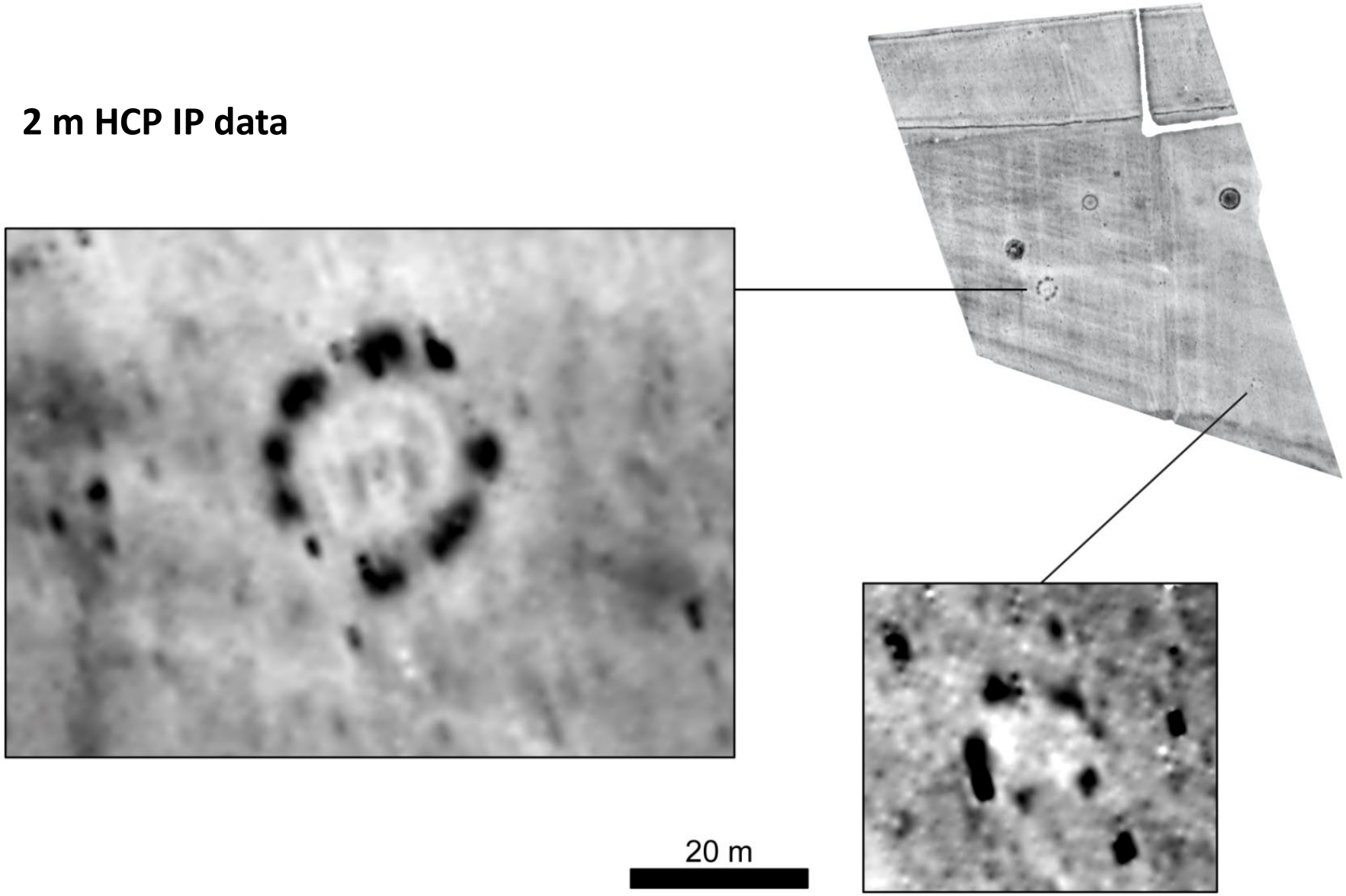
1 m HCP ECa data



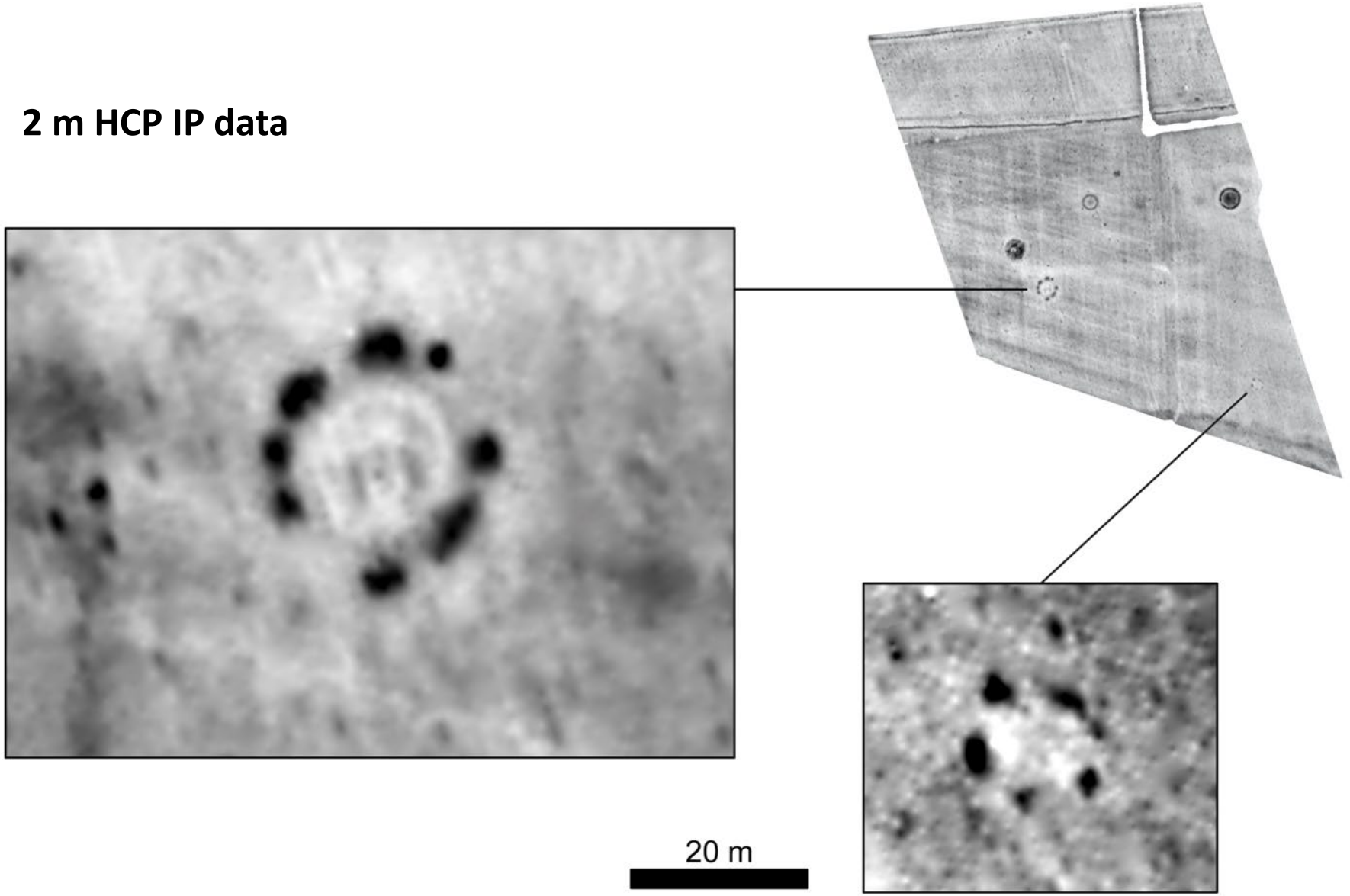
1 m HCP ECa data



2 m HCP IP data

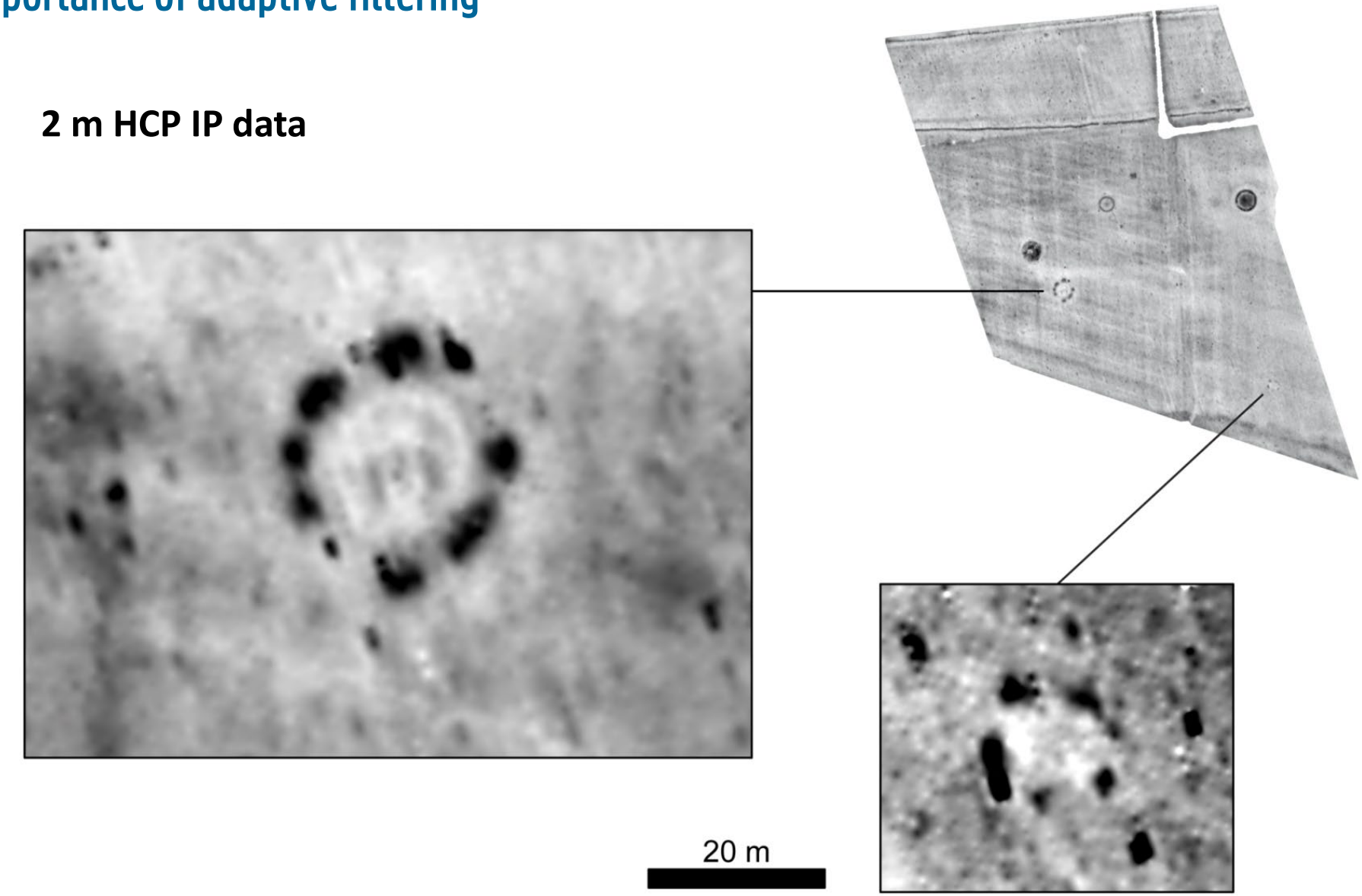


2 m HCP IP data



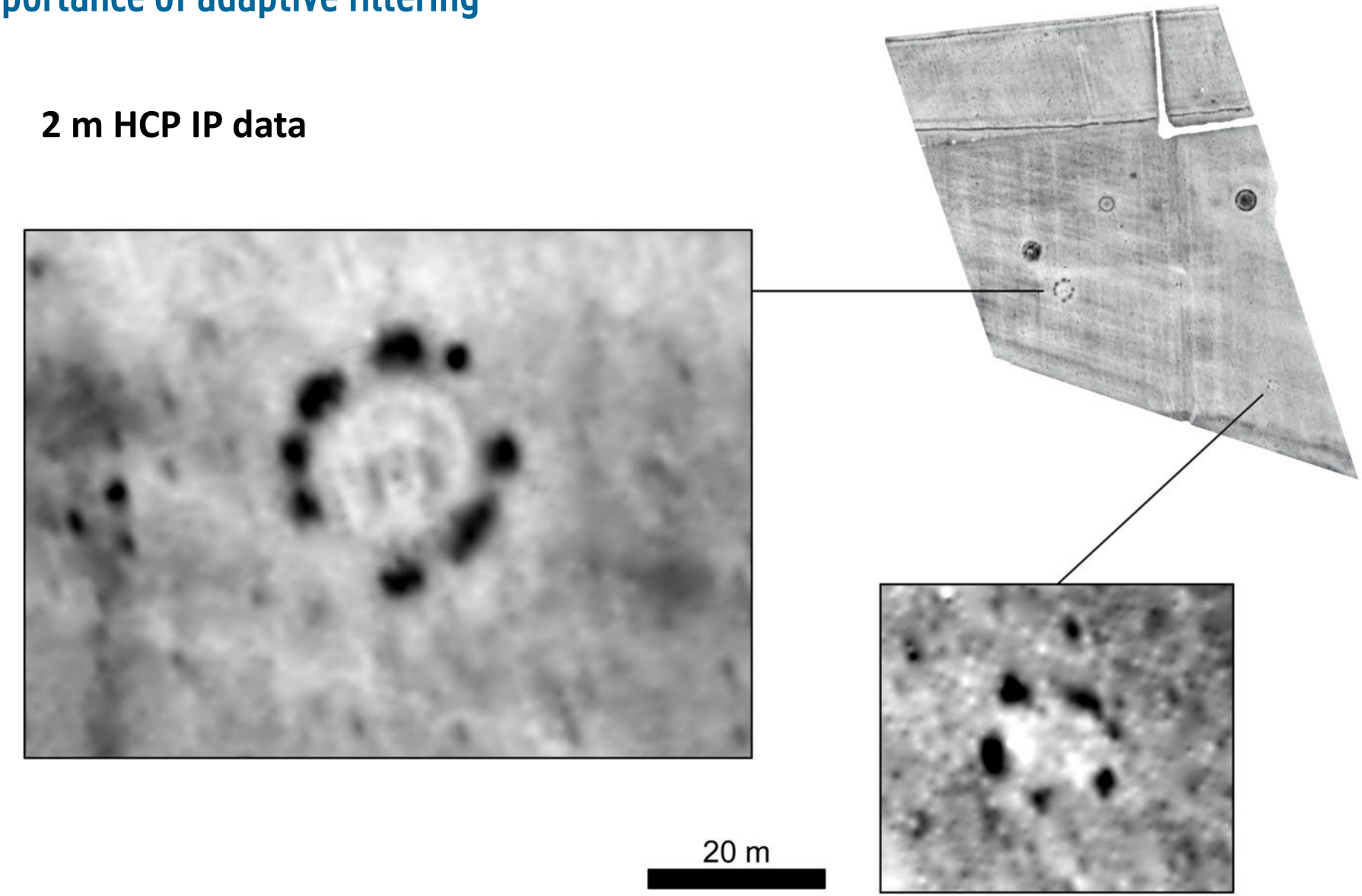
!!! Importance of adaptive filtering

2 m HCP IP data



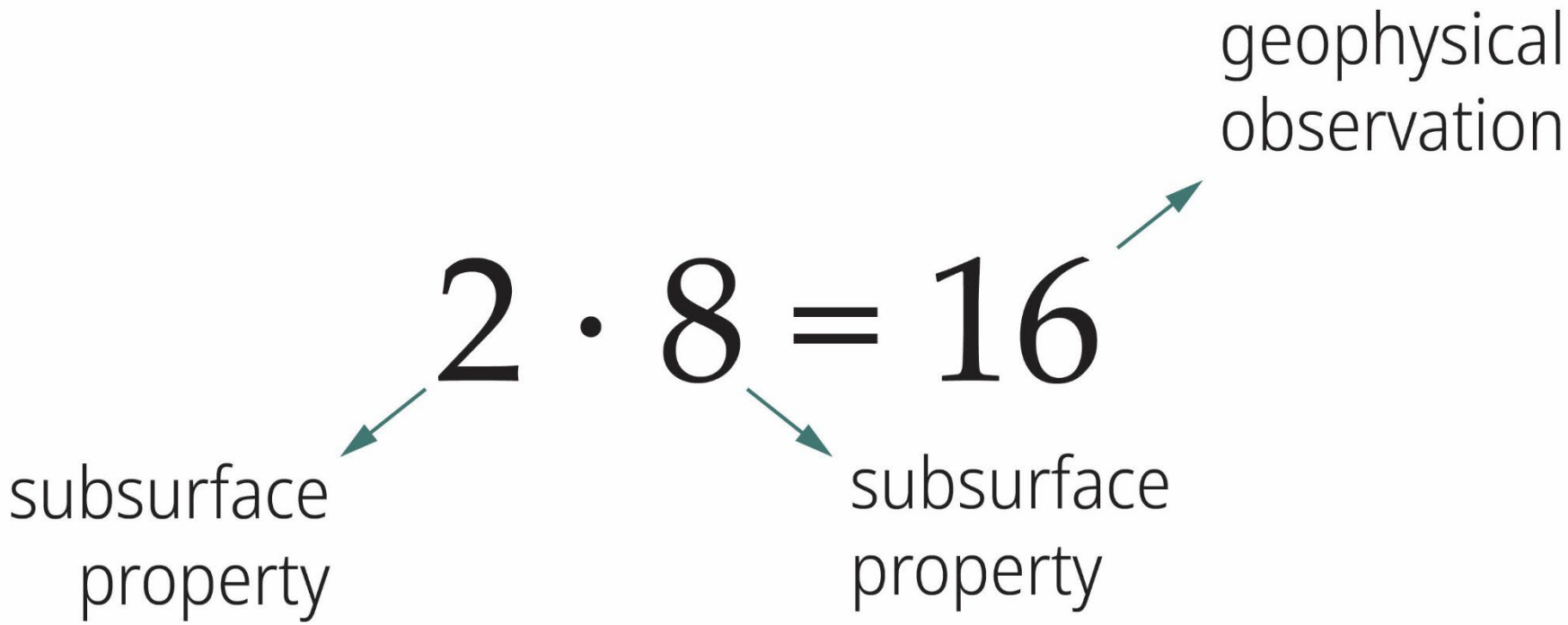
!!! Importance of adaptive filtering

2 m HCP IP data

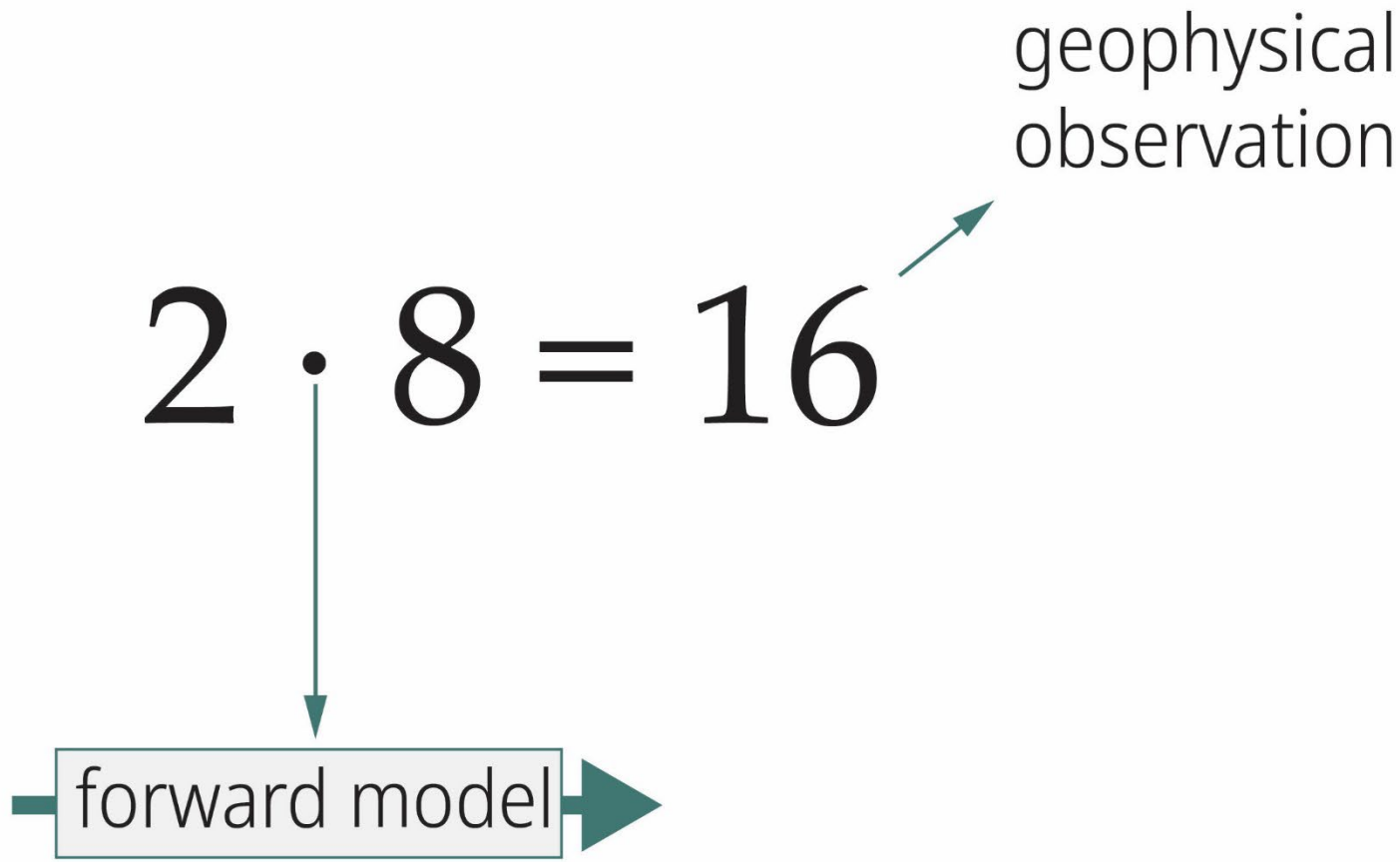


Problem 4: uncertainty

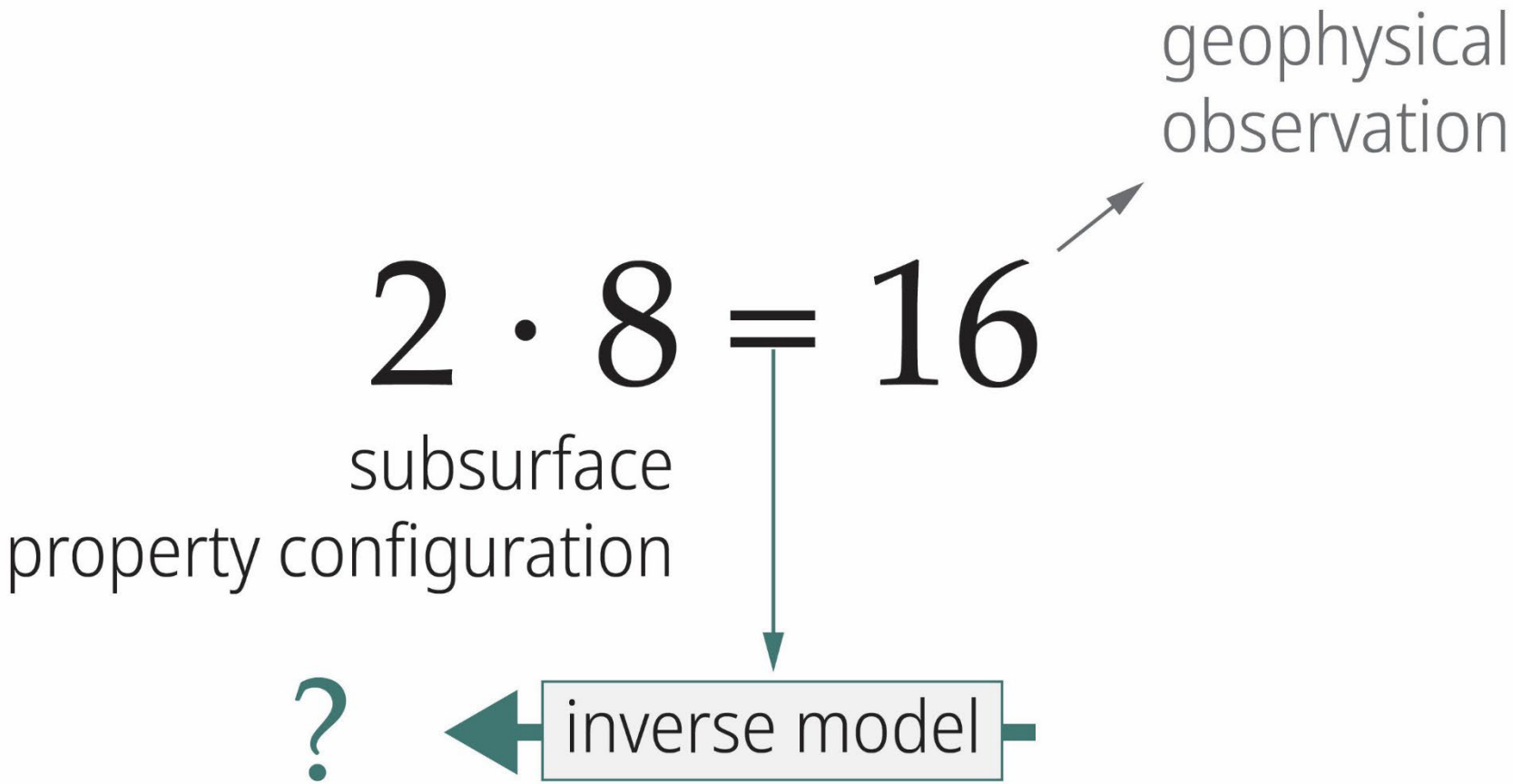
uncertainty



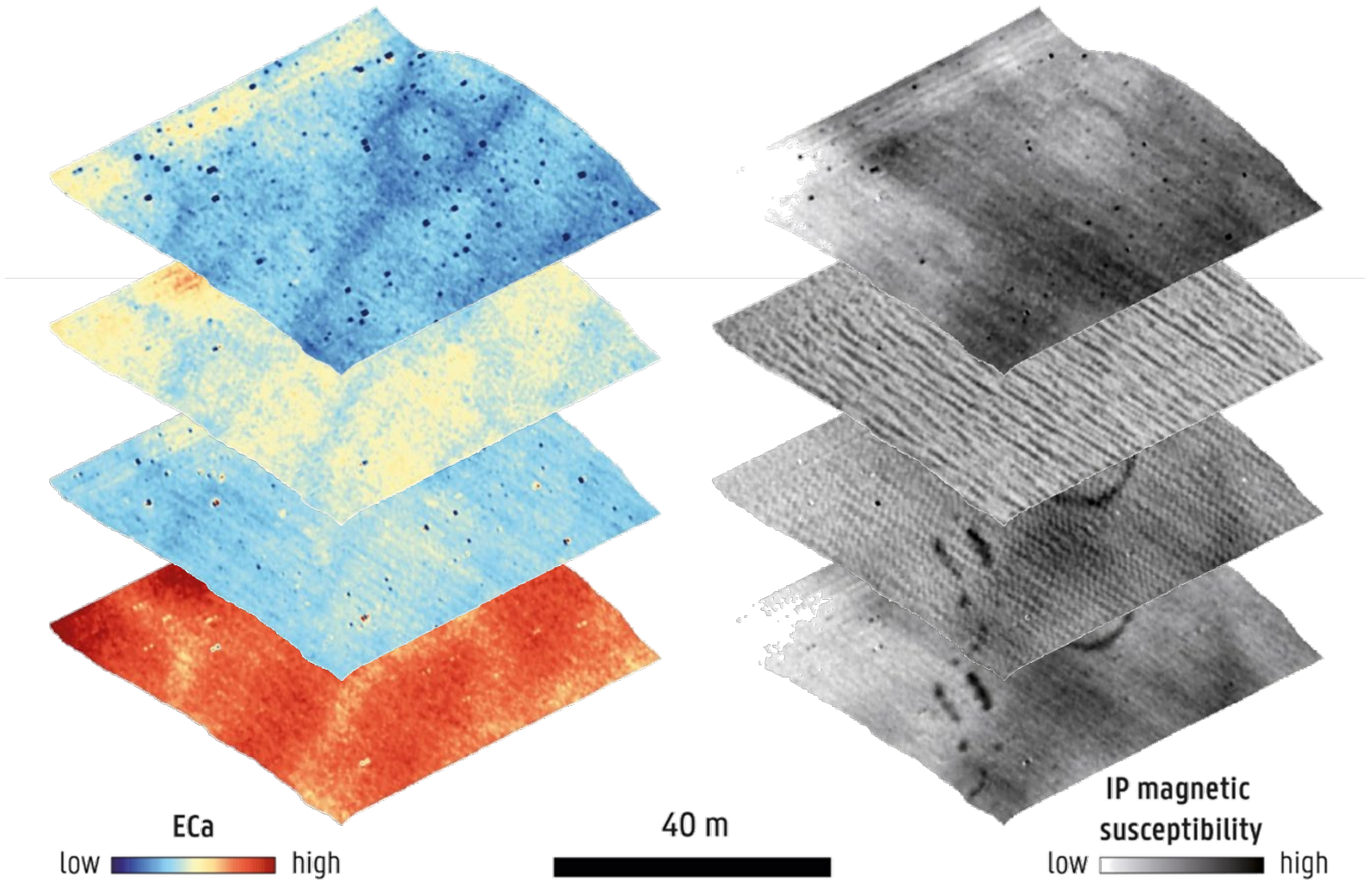
uncertainty

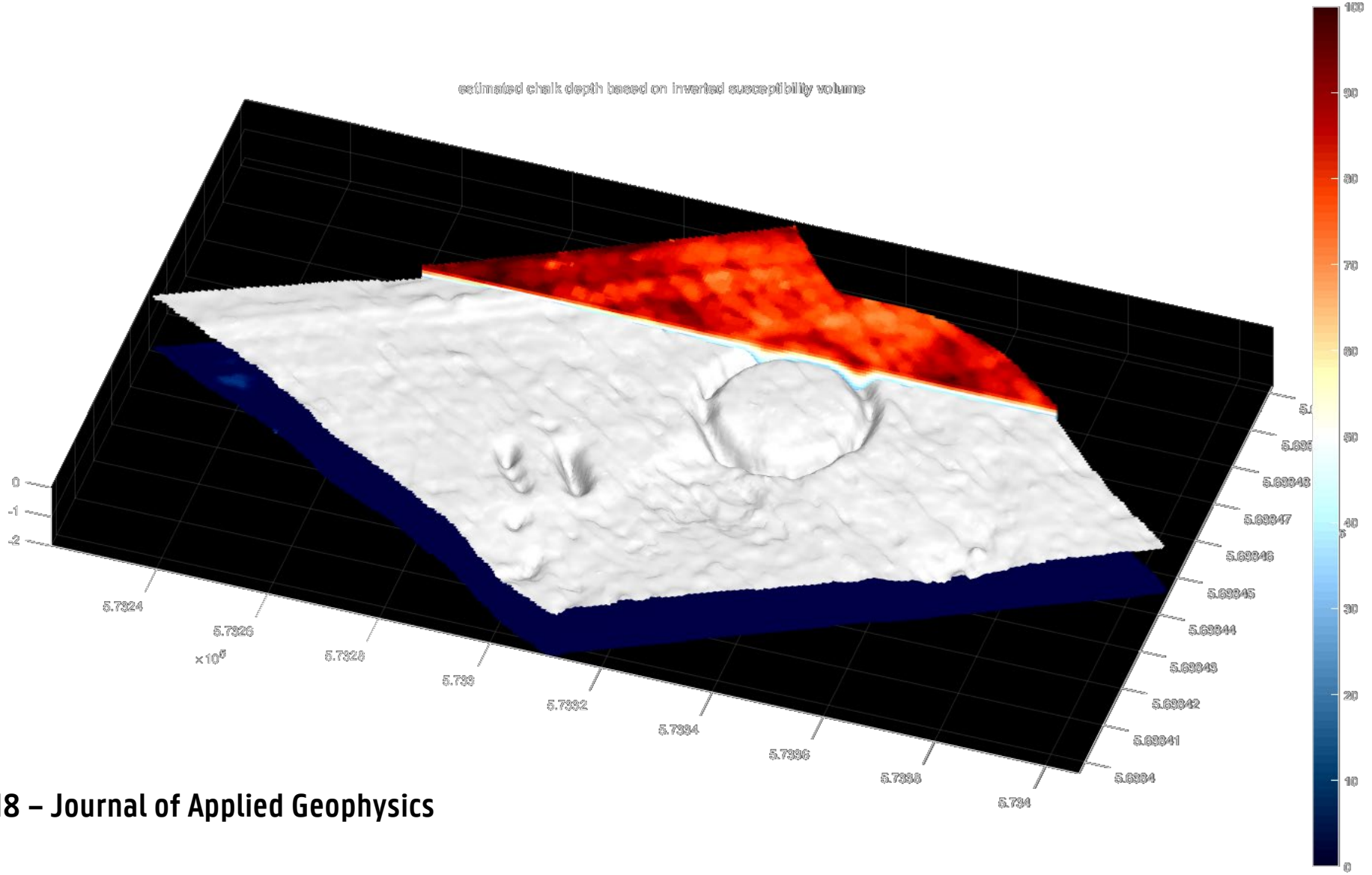


uncertainty



Research topics





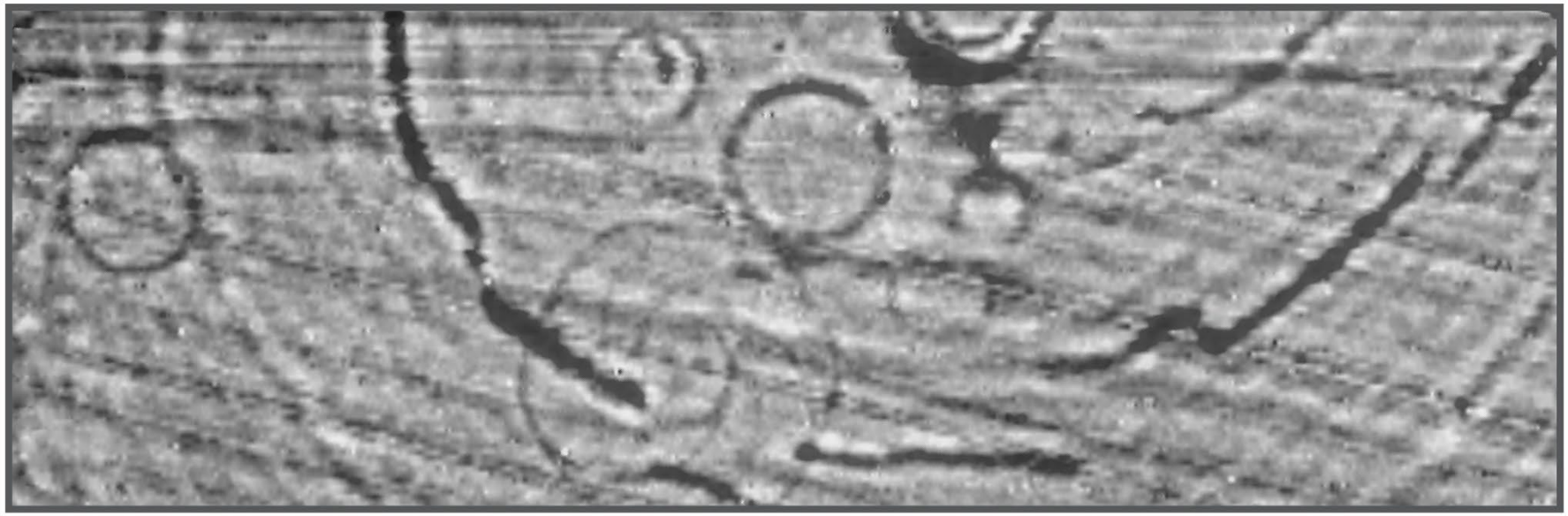
Delefortrie, Hanssens & De Smedt, 2018 – Journal of Applied Geophysics

uncertainty

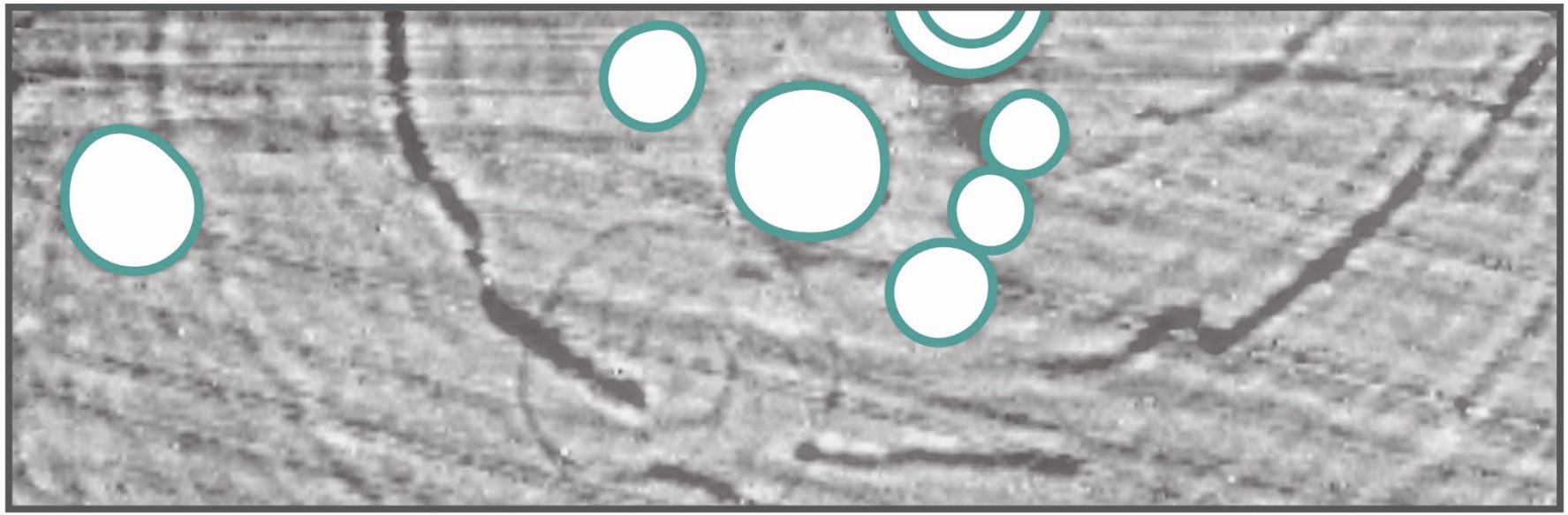
instrument
precision & accuracy

$$2 \cdot 8 = \sim (15{,}18)$$

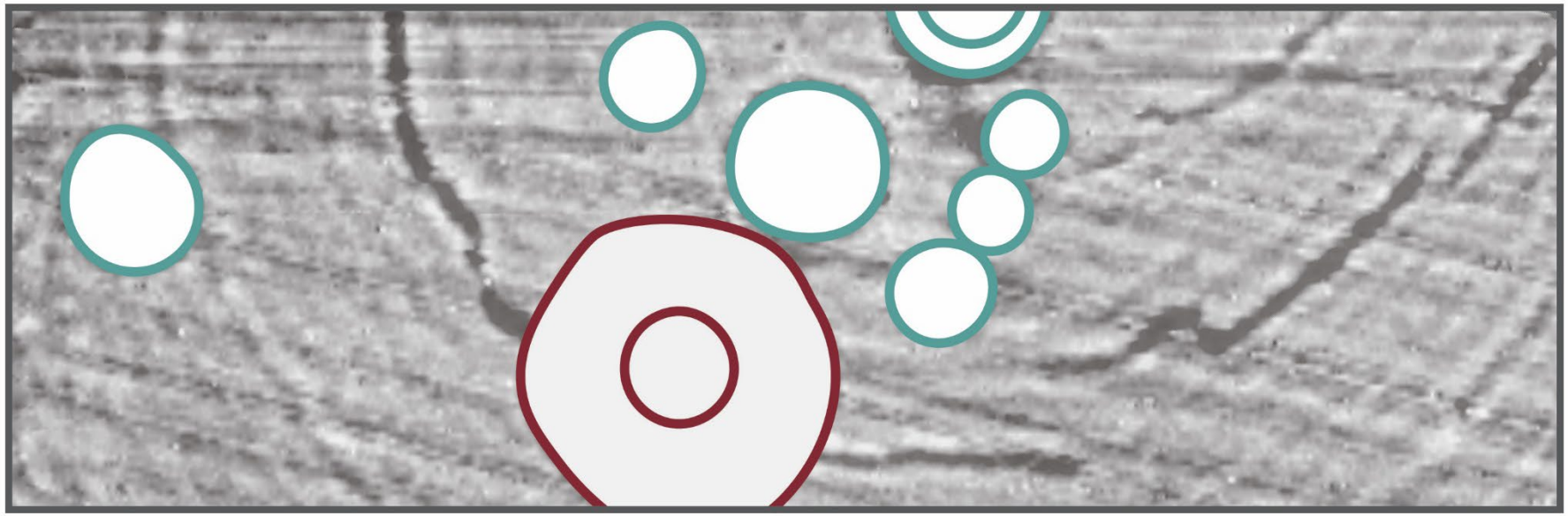
Problem 5: interpretation



100 m



100 m



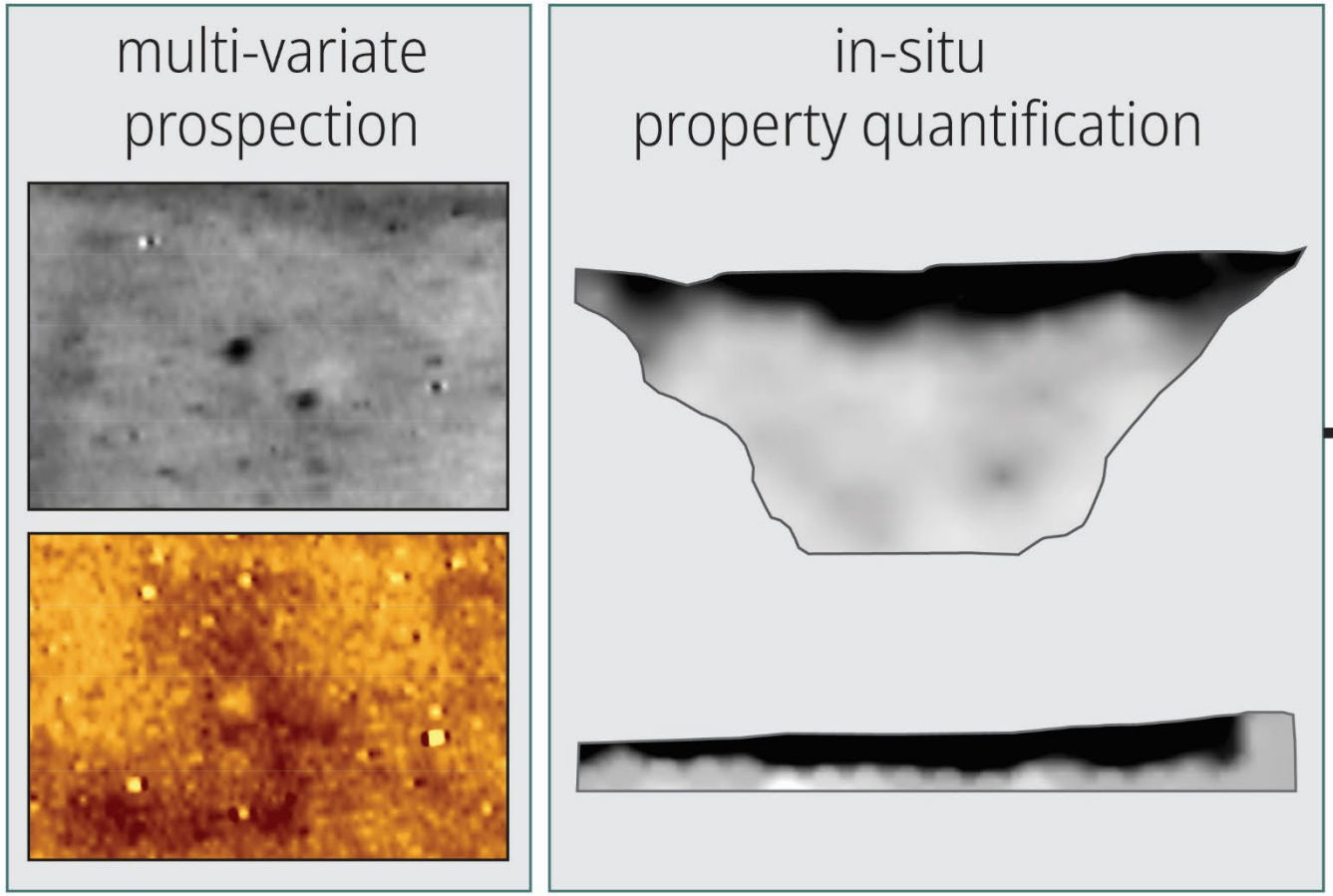
100 m


100 m

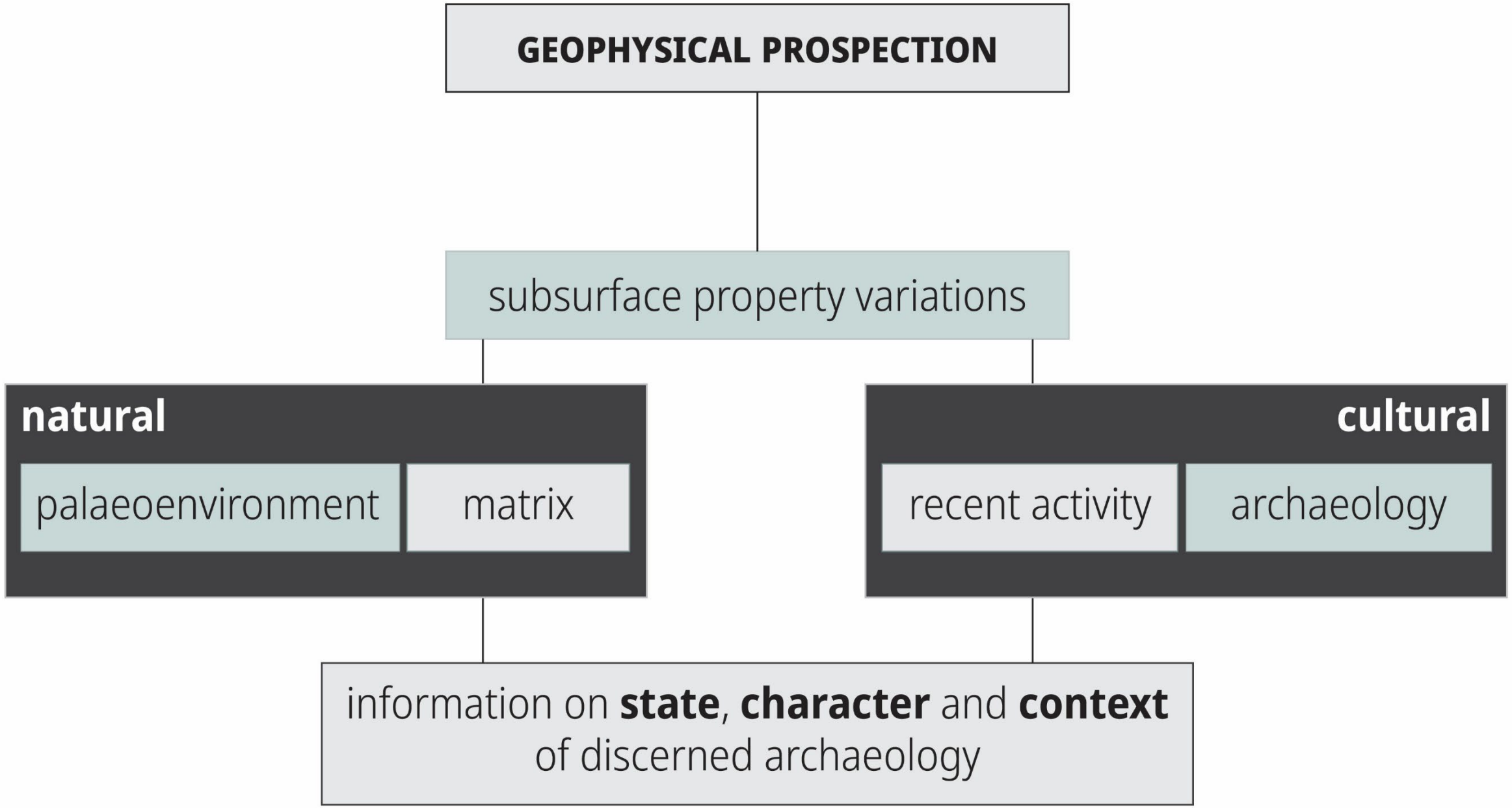

100 m

Problem 5: interpretation

Solution? Complementary data + in-situ validation



more reliable interpretation and classification


GEOPHYSICAL PROSPECTION
subsurface property variations
natural
palaeoenvironment
matrix
cultural
recent activity
archaeology
information on **state**, **character** and **context** of discerned archaeology