

Multicomponent DAS sensing: smaller sensors and field testing

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Why?

- Fiber broadside insensitivity
 - Helical Fiber

Prior multi-component shaped fiber work (CREWES)

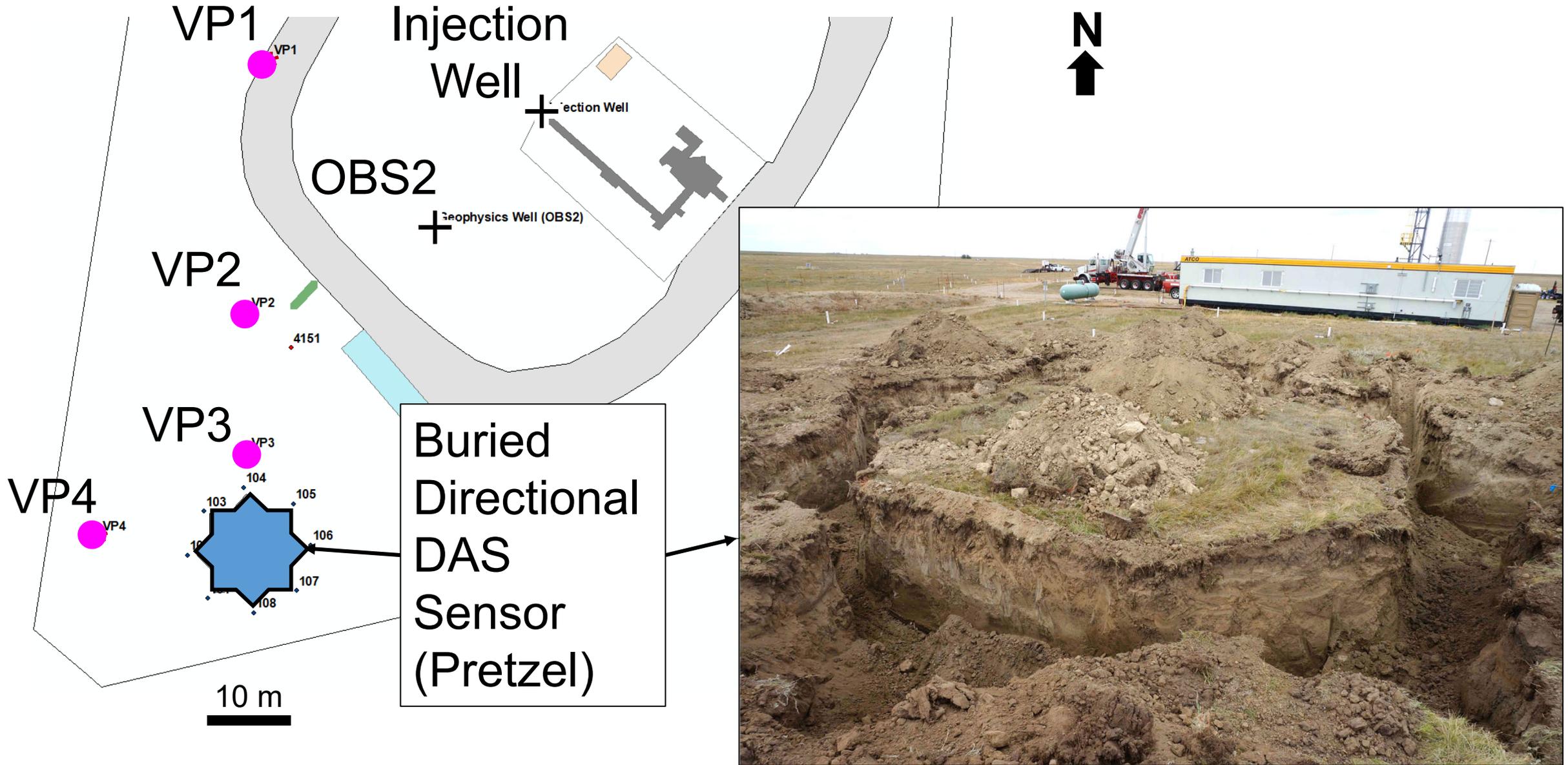
- Pretzel
 - Large [10 m Sides > 7 m Gauge length]
 - 2C; No Vertical Component

This Report

- Croissant
 - Smaller [1 m Sides < 7 m Gauge length]
 - 3C



Pretzel 2018: Field Geometry



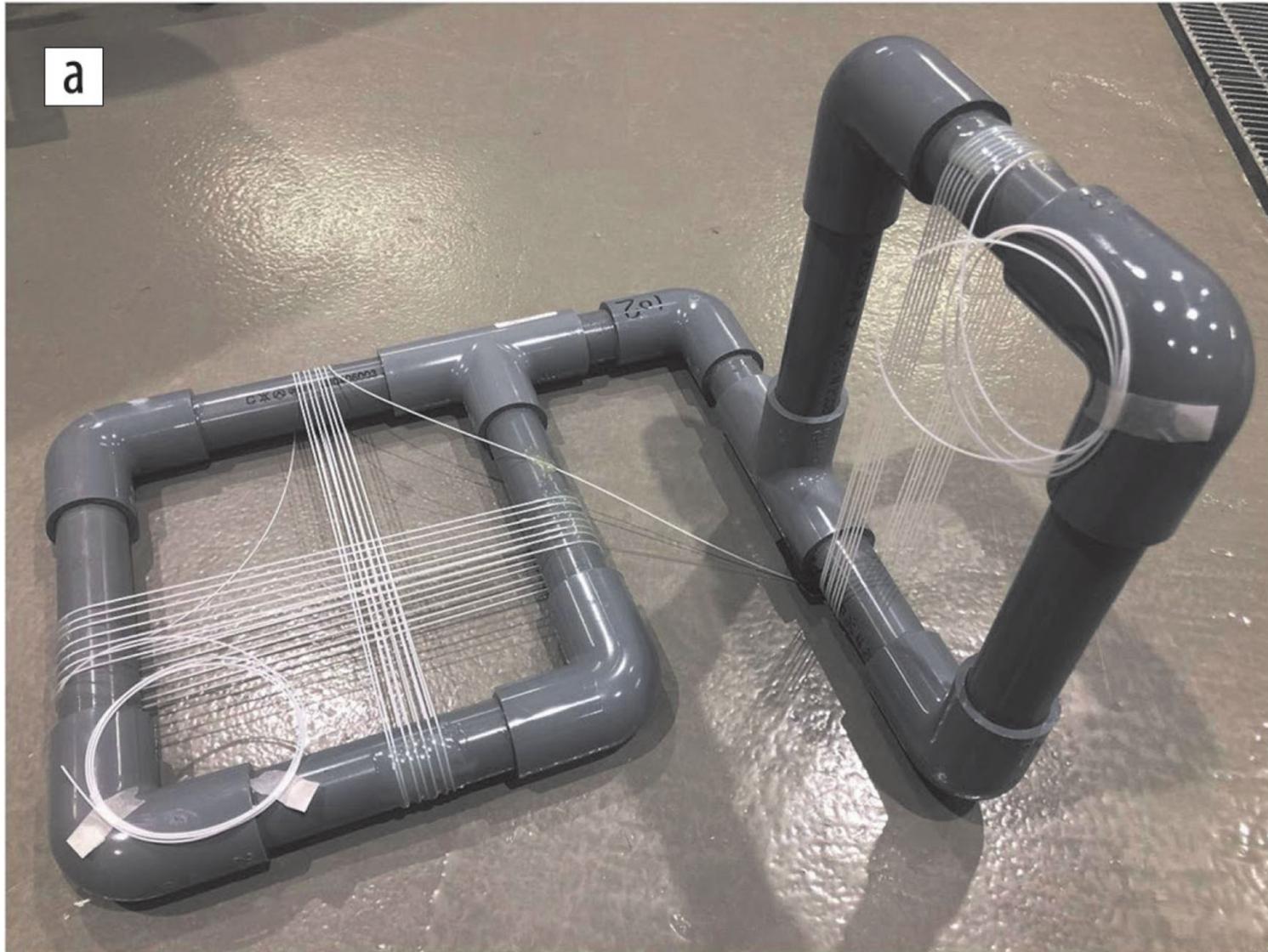


Figure 1a

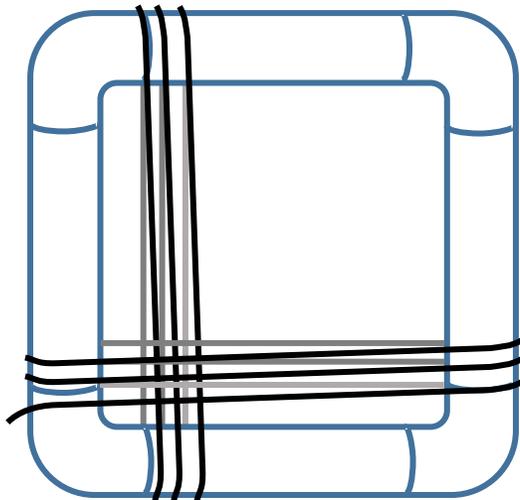
Takekawa, J., Mikada, H., Xu, S., Uno, M., Kamei, S., Kishida, K., Azuma, D., Aoyanagi, M., Tanaka, N., and Ichikawa, H., 2022, A new DAS sensor prototype for multicomponent seismic data, *The Leading Edge*, **41**, 338–346



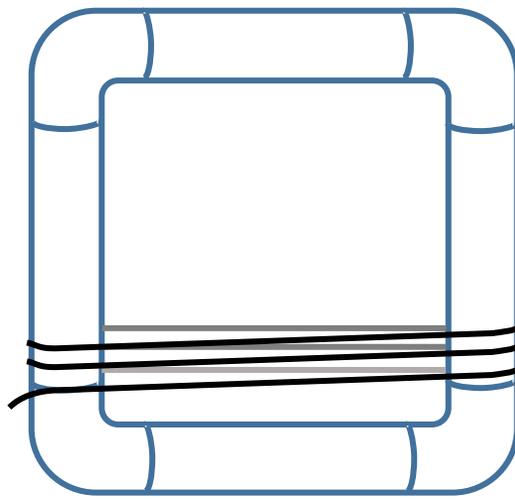
Croissant 2022: Design, with 2023 updates

- 2 1x1 m plastic frames
- Fiber wrapped around the frames in two orientations
- Frames buried in two orientations
- Number of wraps per component [14 wraps, 28 m of fiber]
- Length of cable between components: [as little as possible]

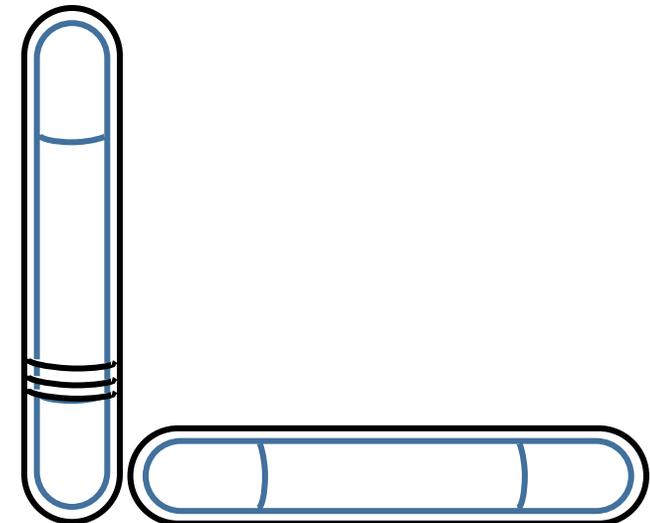
Side view
Vertical and Horizontal 1



Side view
Horizontal 2



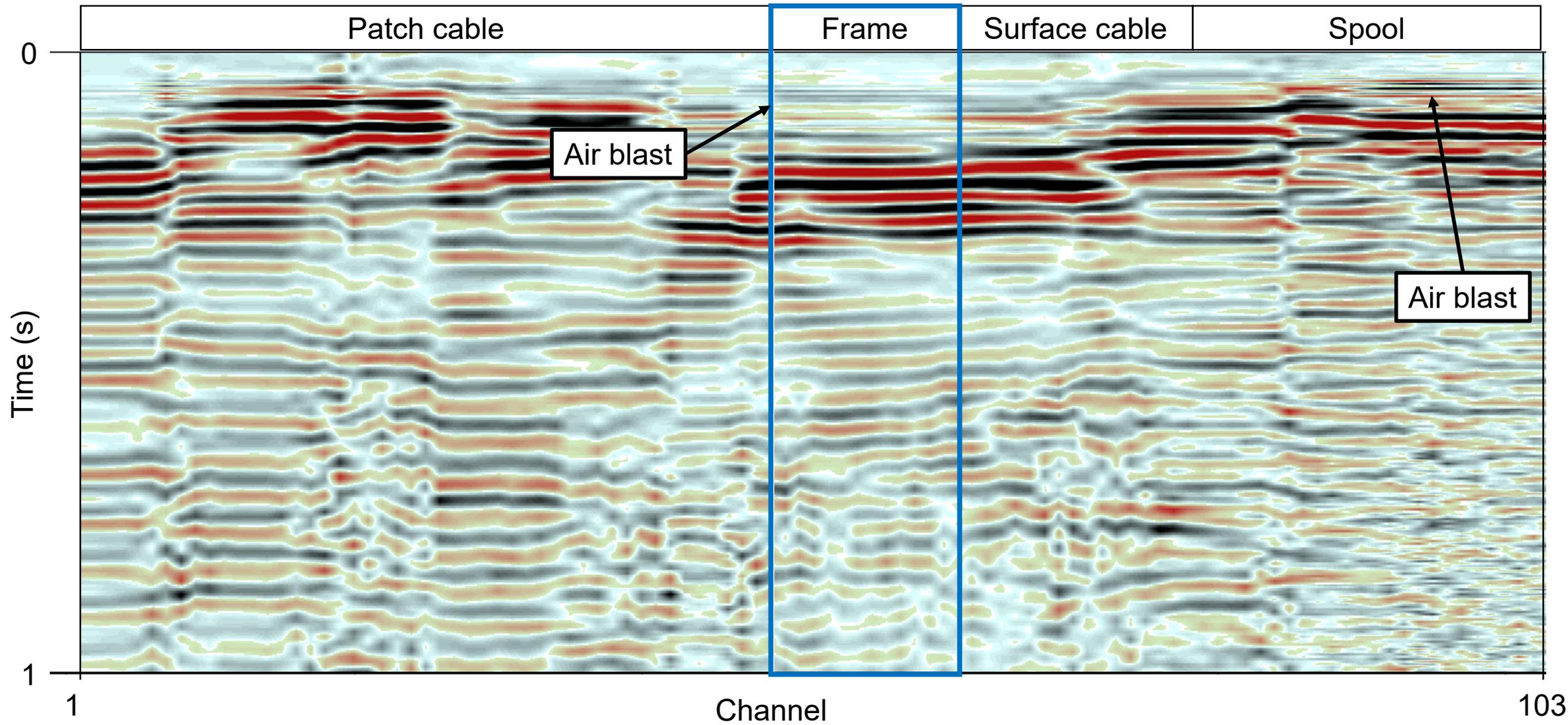
Top view
Axis vertical, Horizontal 1 and 2





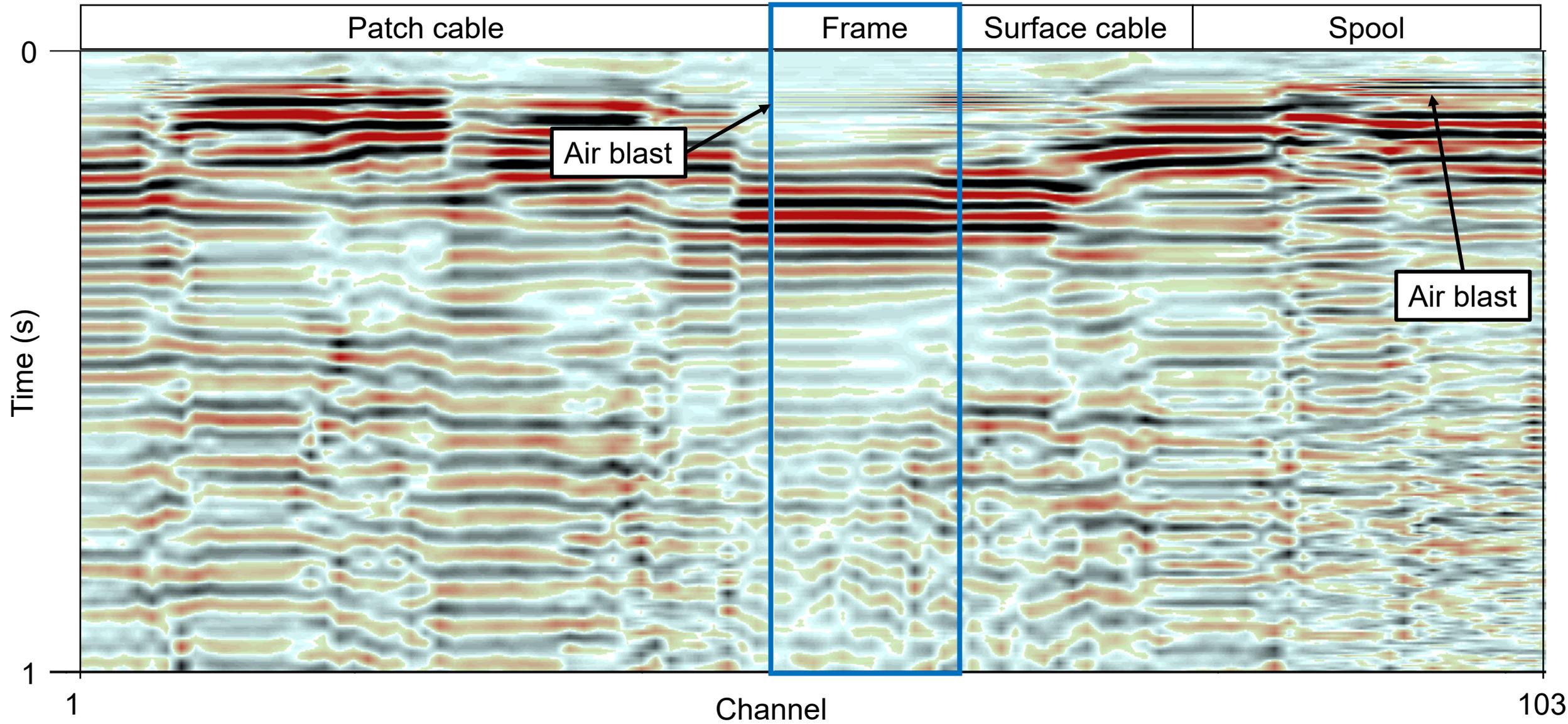


Croissant 2022: Field Tests; Fiber in-line, Spool axis vertical





Croissant 2022: Field Tests; Fiber cross-line, Spool axis vertical



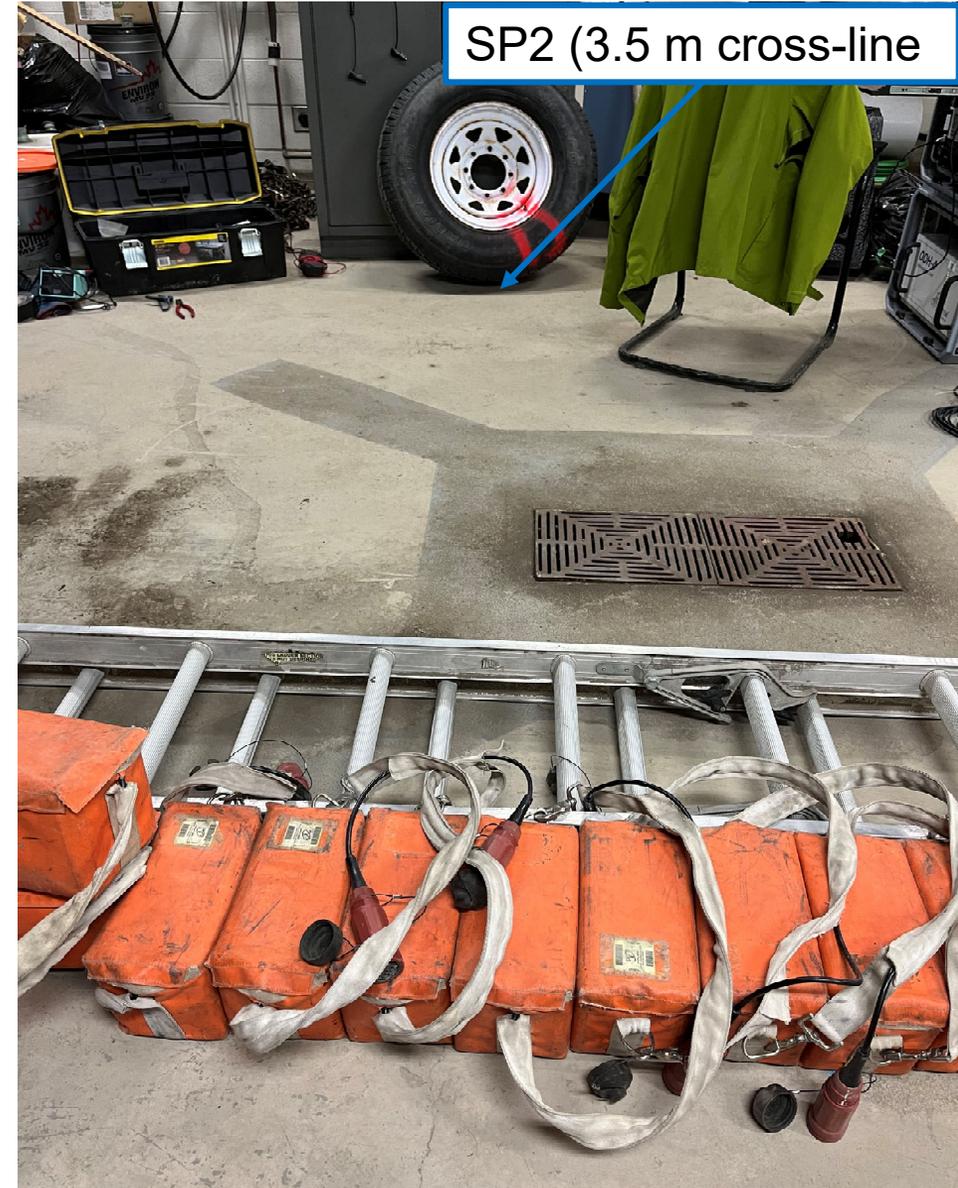


Croissant 2023: Lab Tests; 7 m frame, 28 m of fibre on frame

a)



b)



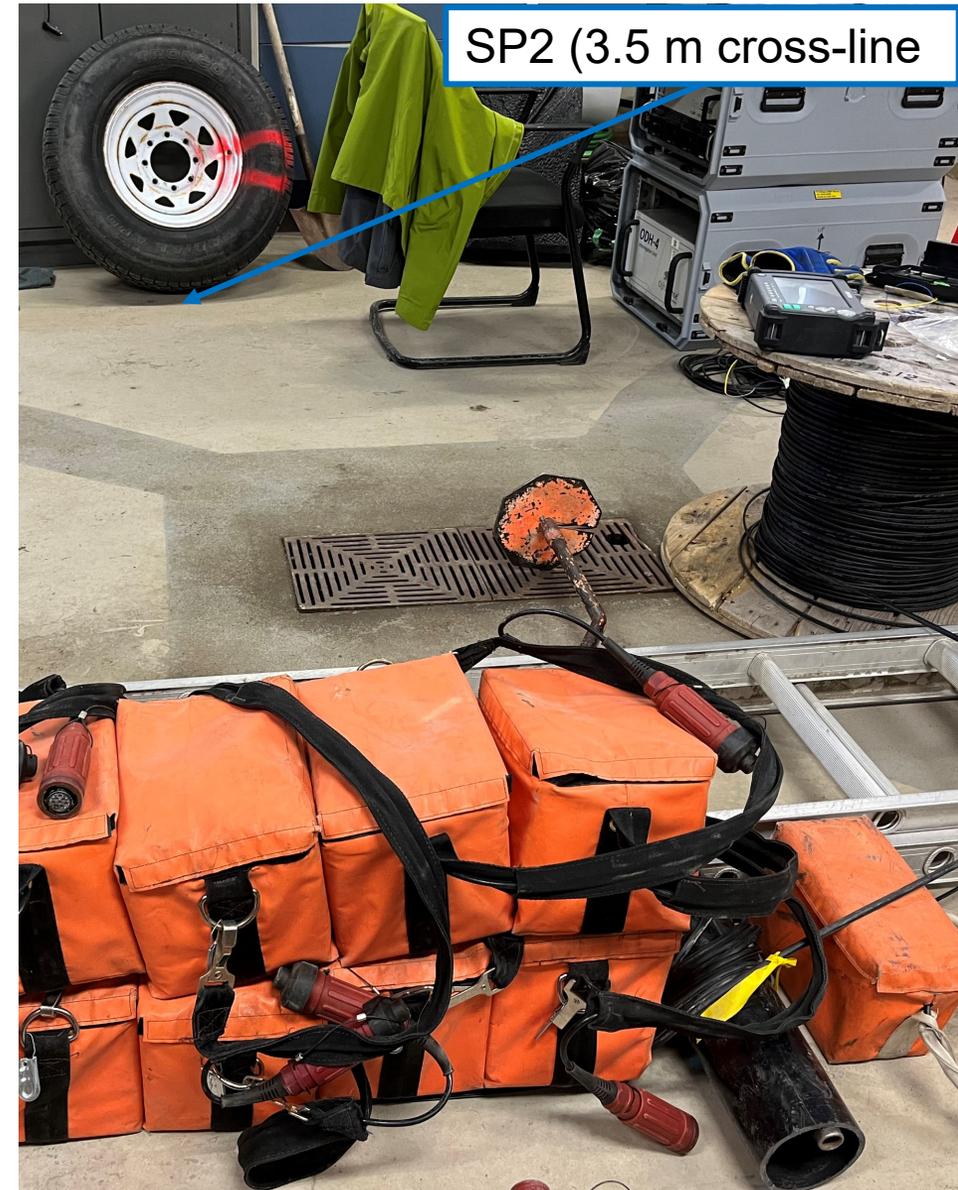


Croissant 2023: Lab Tests; 1 m frame, 28 m of fibre on frame

a)

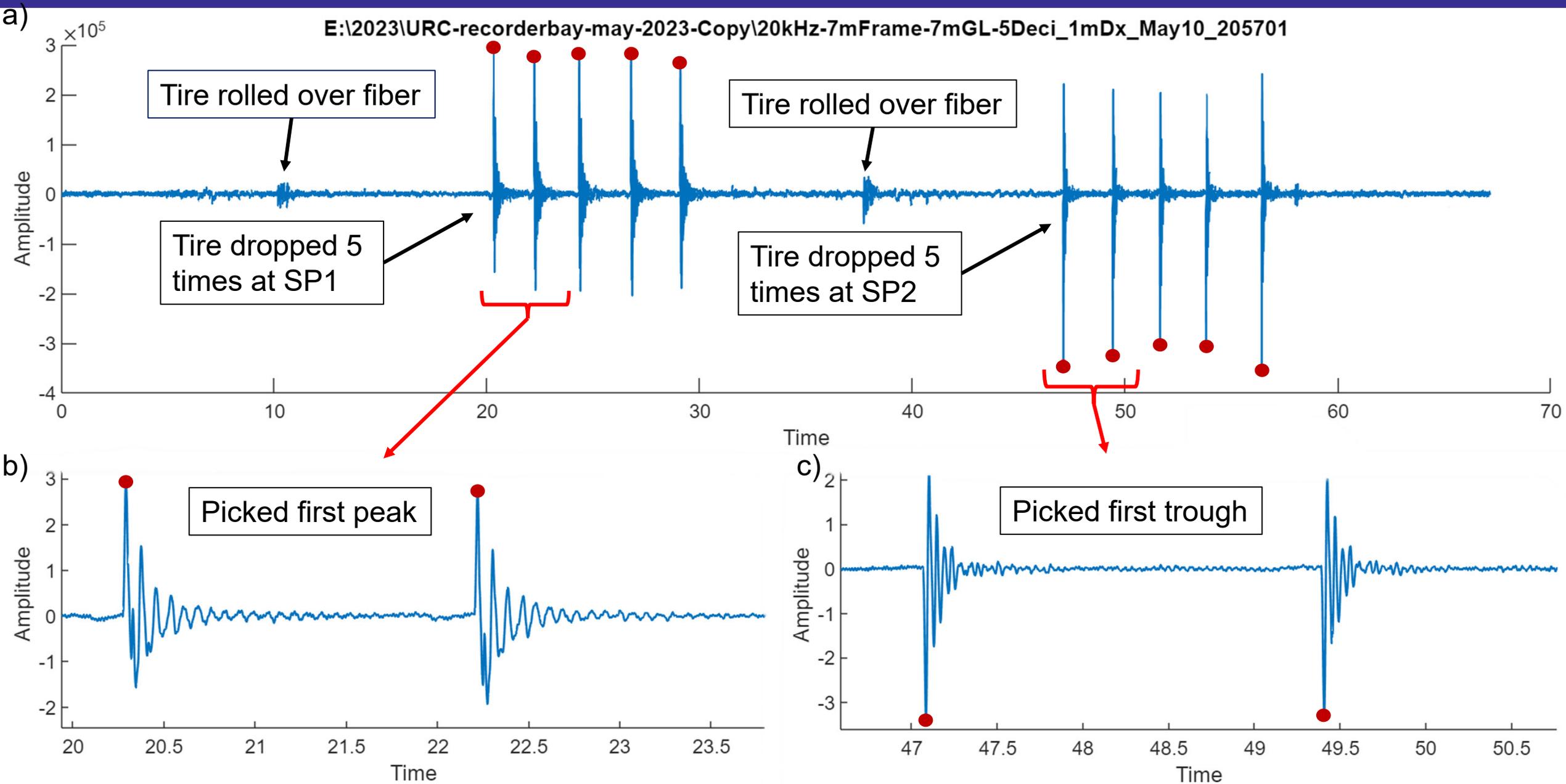


b)





Croissant 2023: Lab Tests; 7 m frame, 28 m fibre

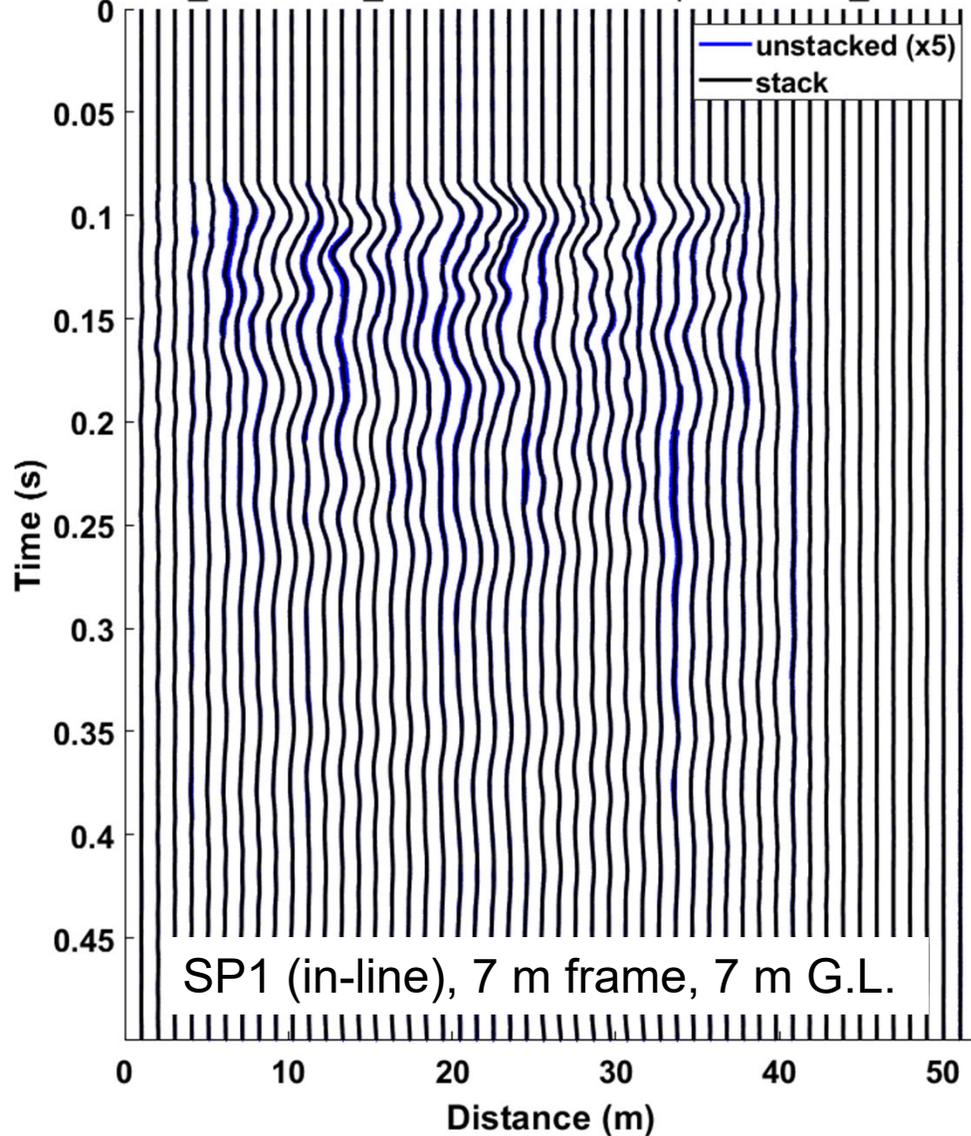




Croissant 2023: Lab Tests; 7 m frame, 28 m fibre

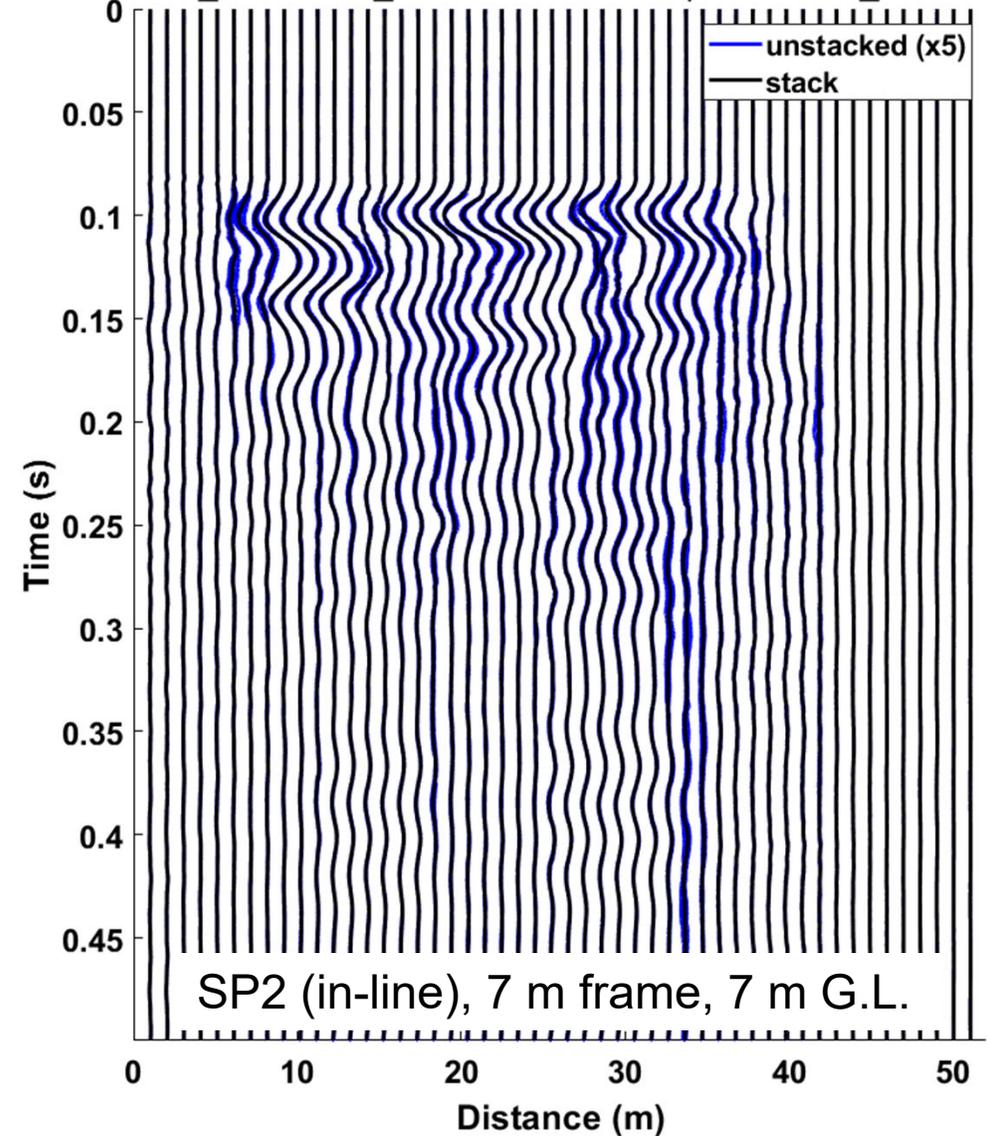
a) SP1: 20kHz-7mFrame-7mGL-5Deci_1mDx_May10_205701

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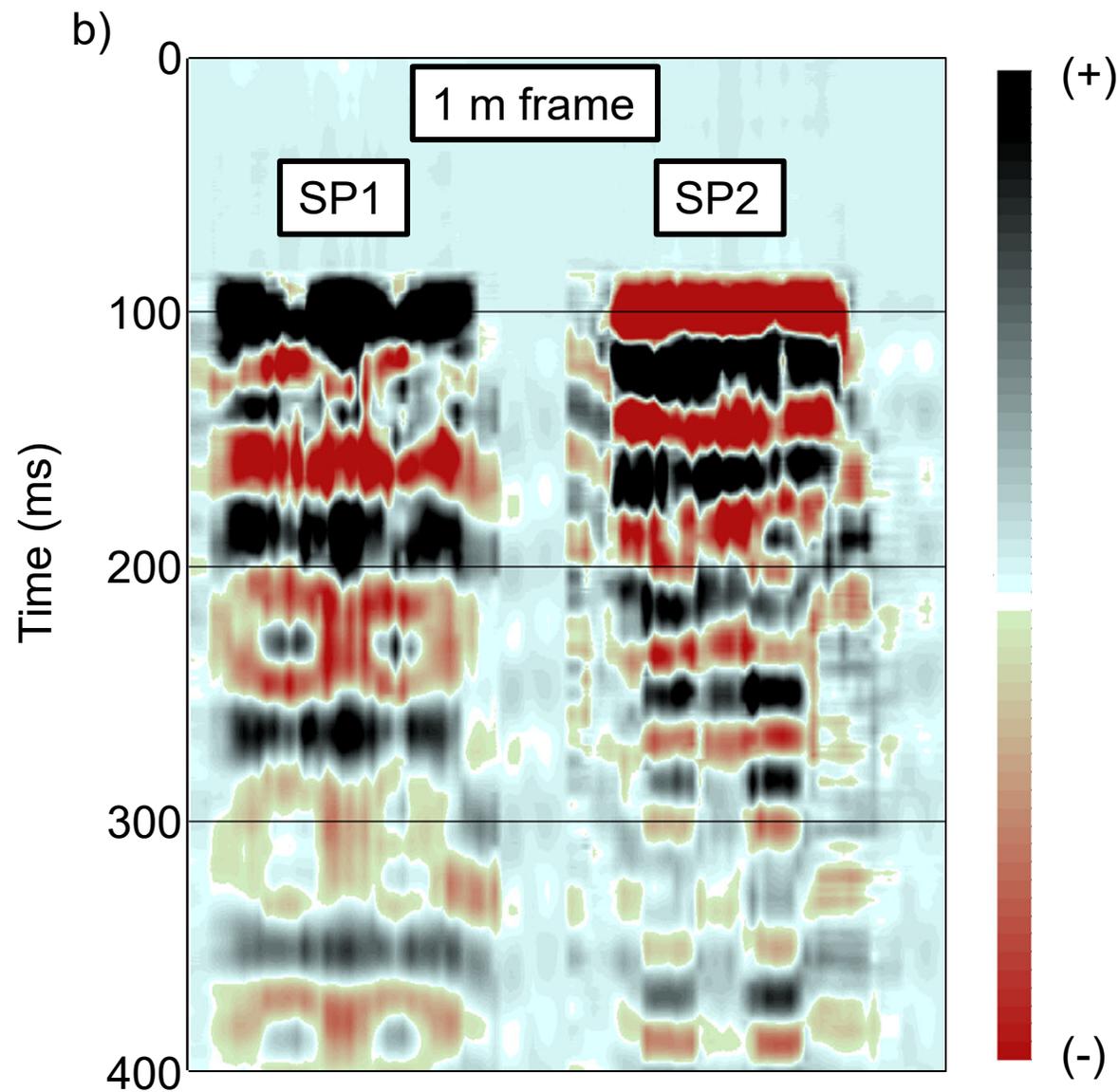
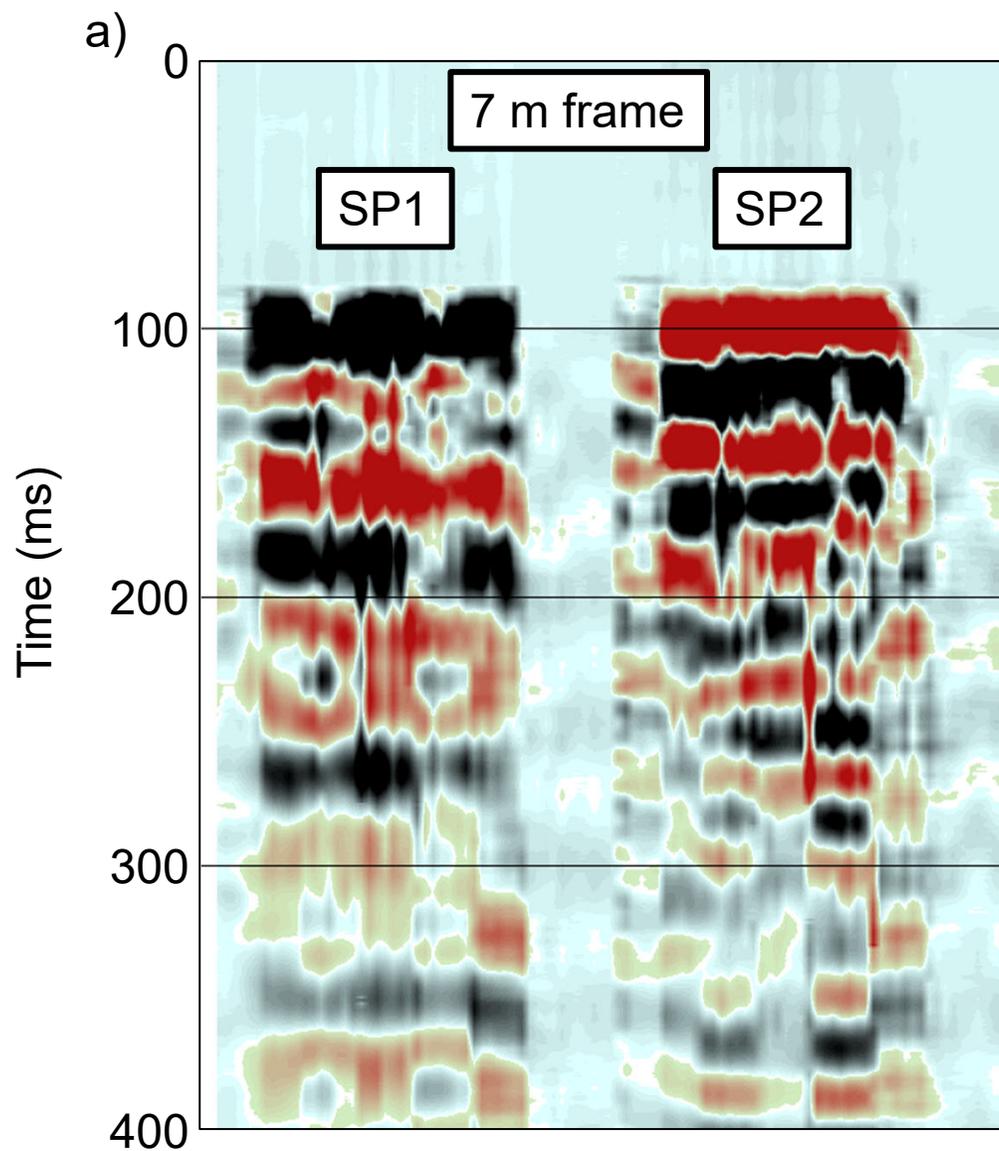
b) SP2: 20kHz-7mFrame-7mGL-5Deci_1mDx_May10_205701

sensor_20230510_205724.902+0000.prodml.das_stack.mat



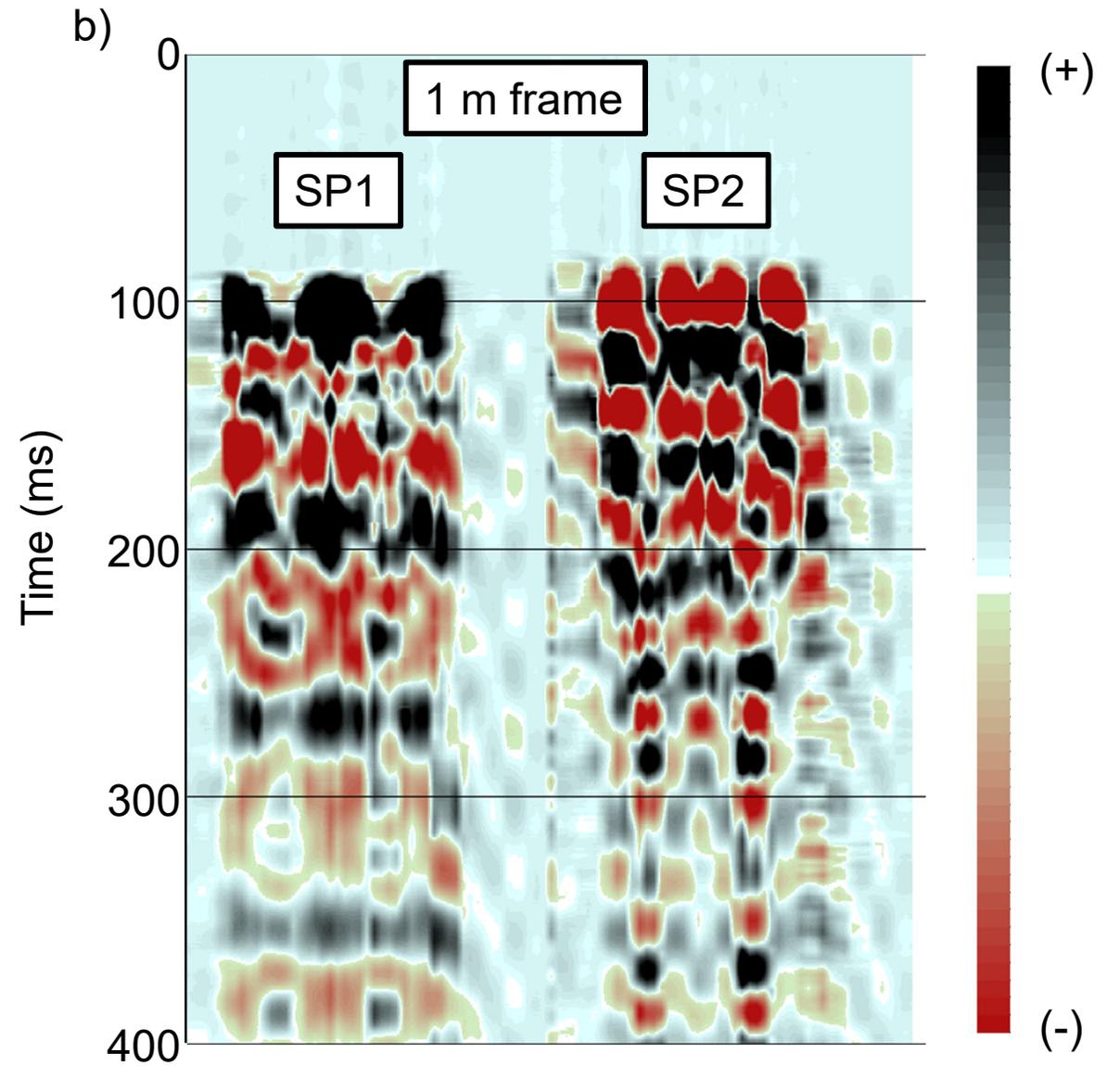
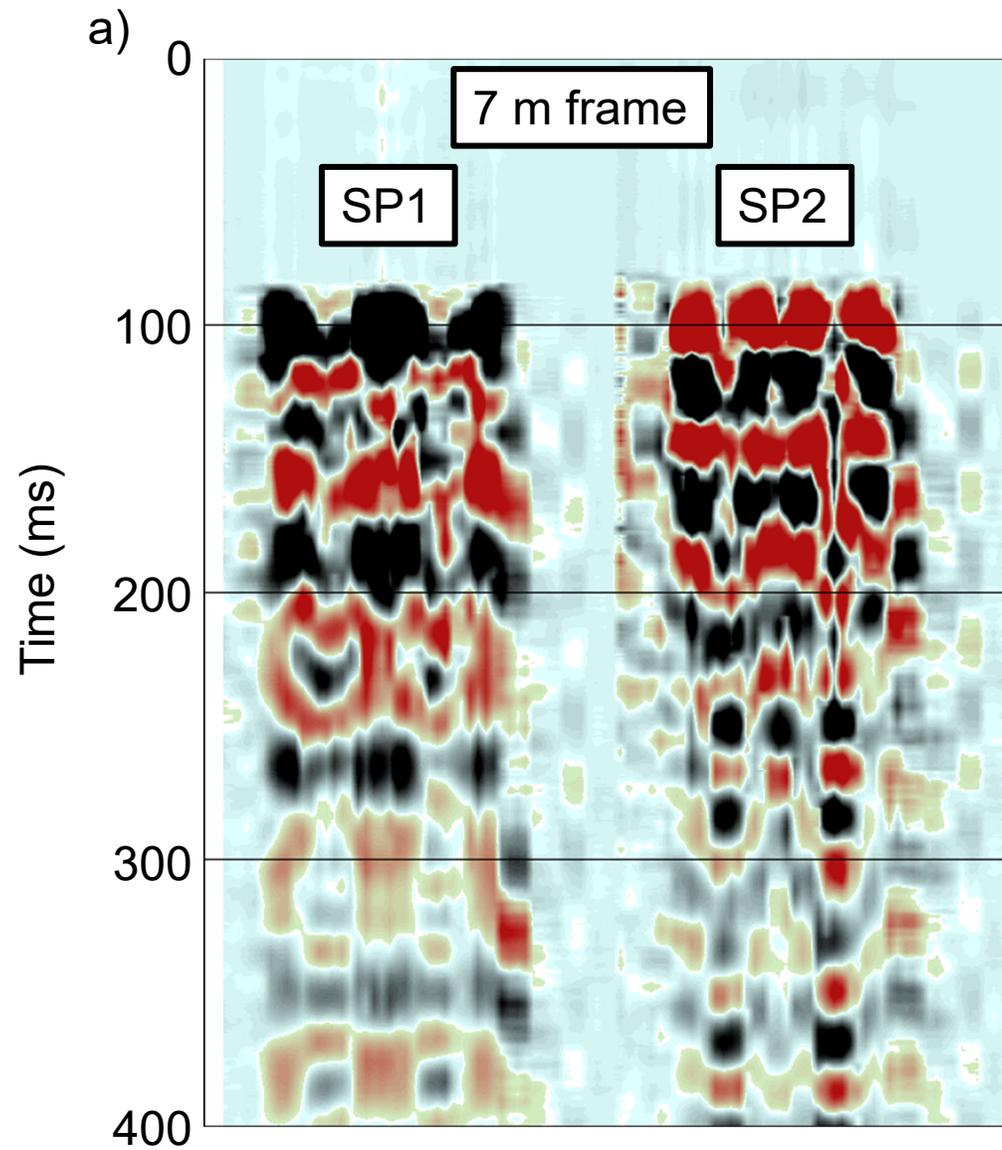


Croissant 2023: Lab Tests; 7 m gauge length

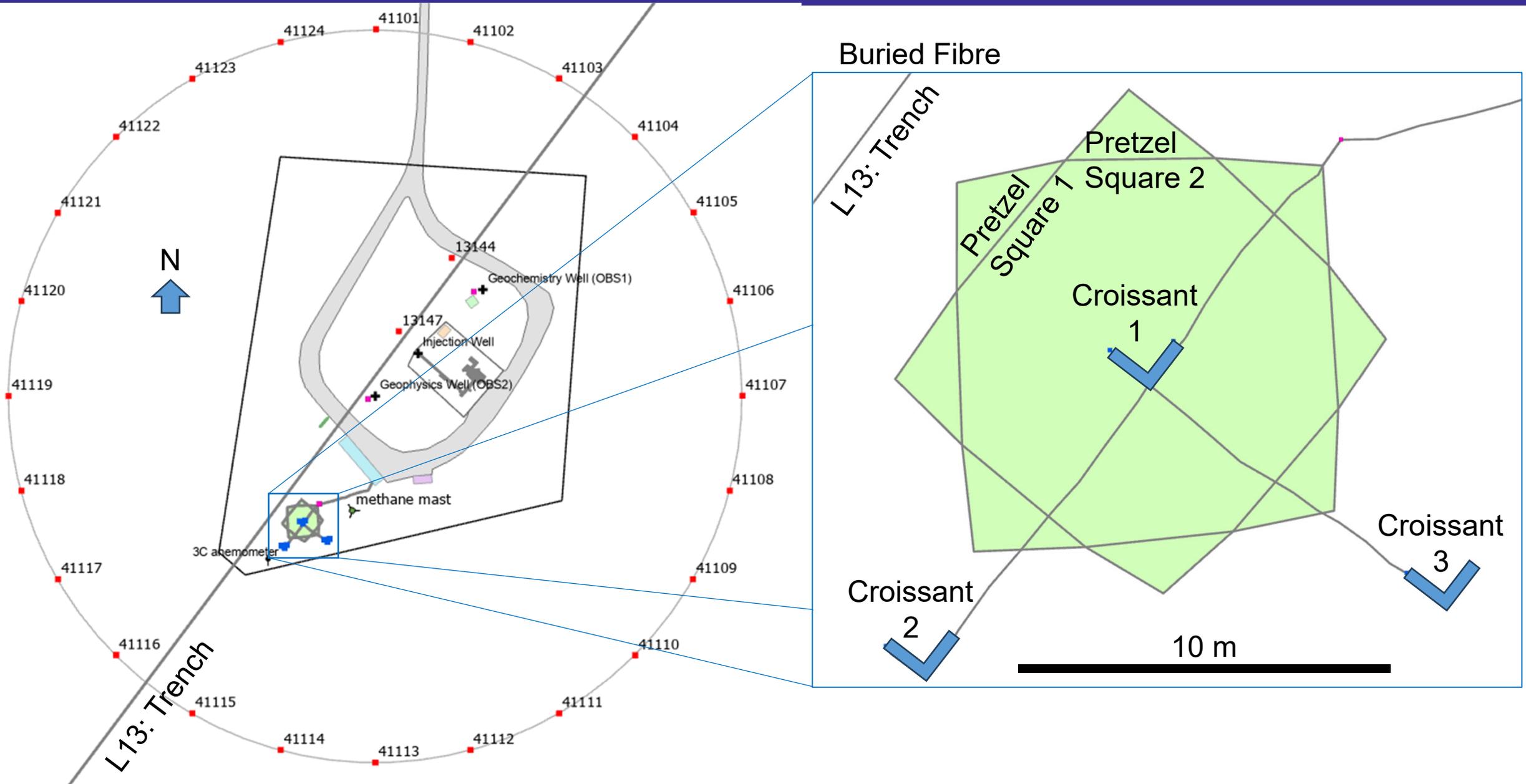




Croissant 2023: Lab Tests; 4 m gauge length

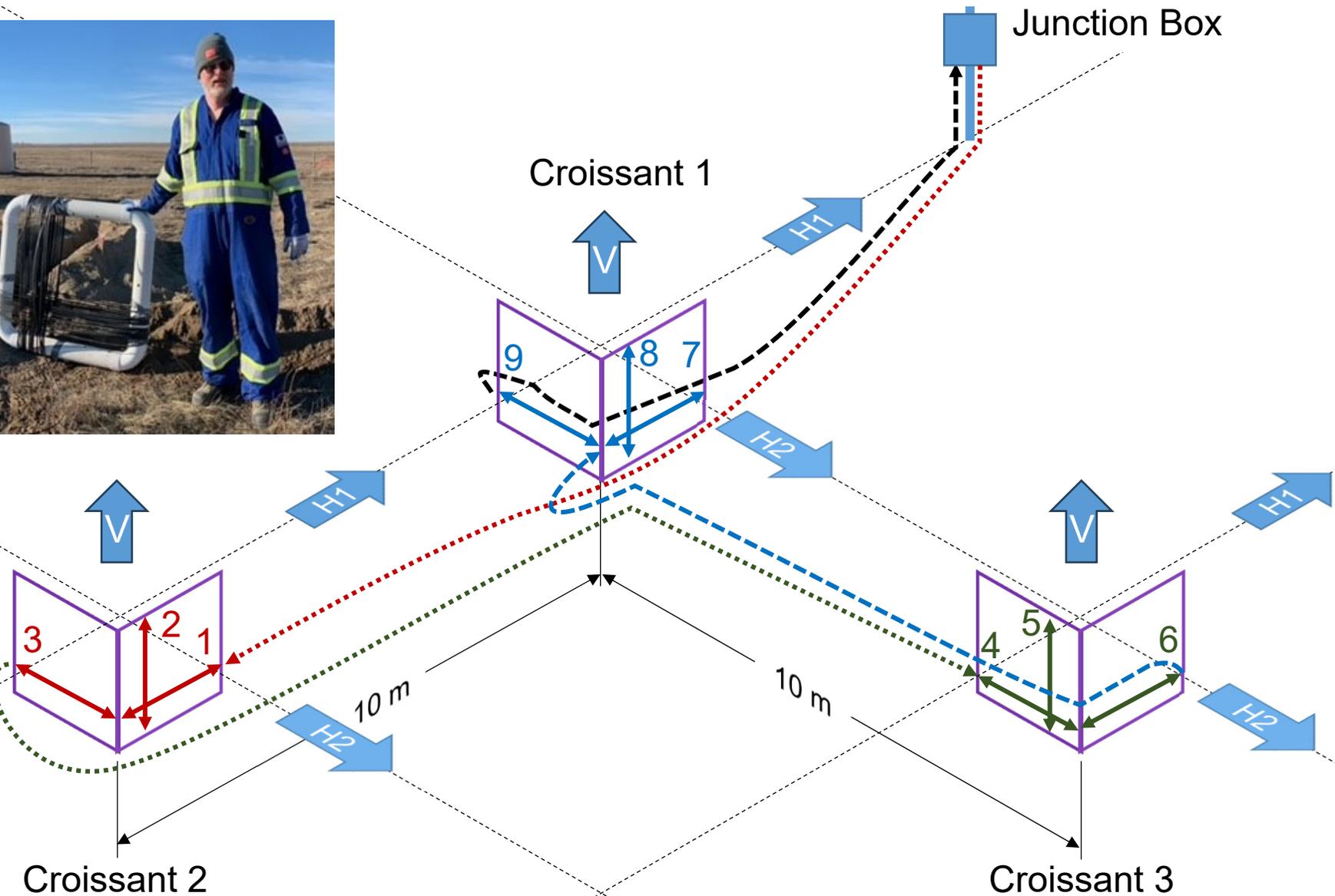


Croissant 2023: Field Tests; Map



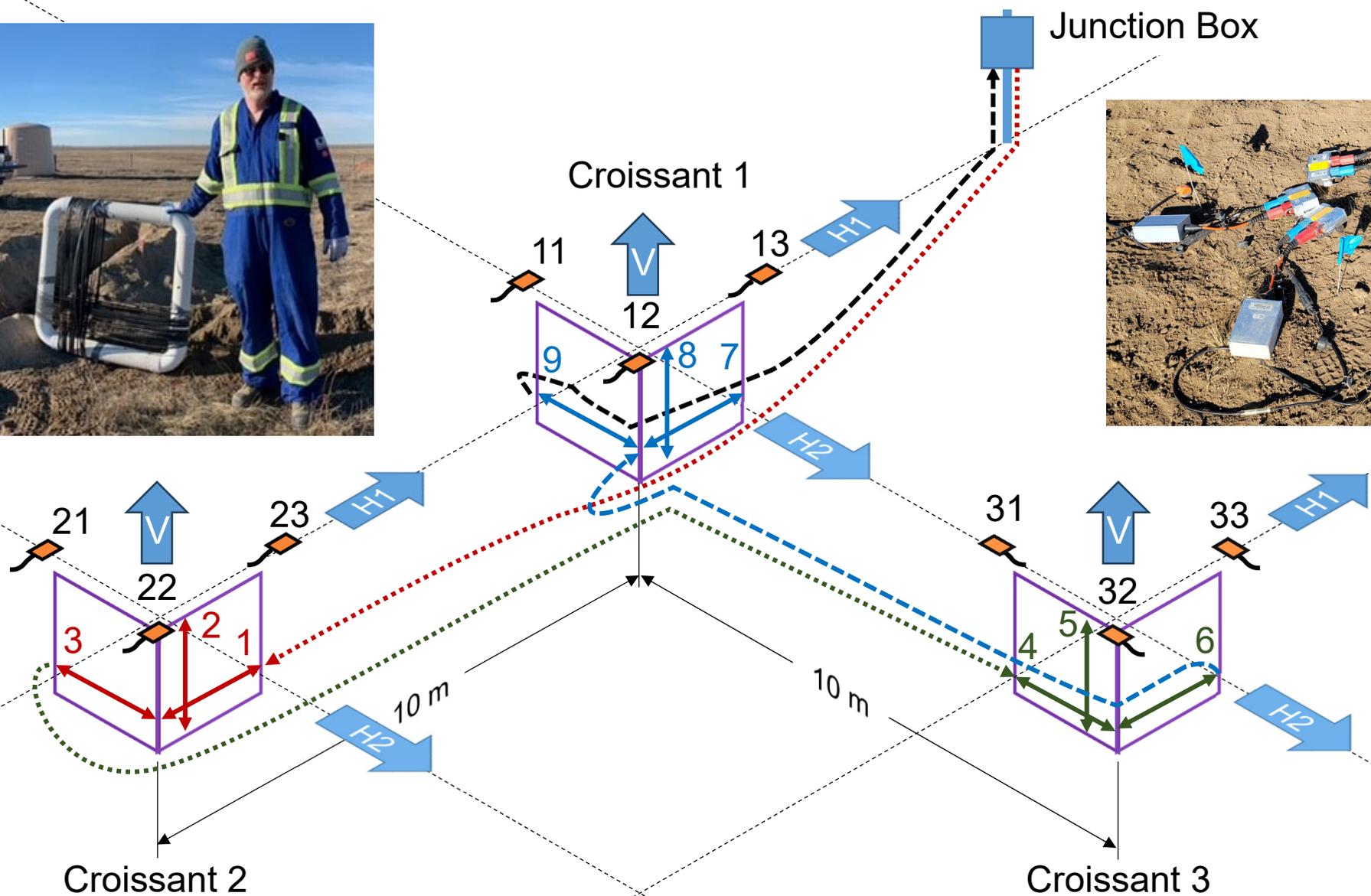


Croissant 2023: Field Tests; Fiber Path





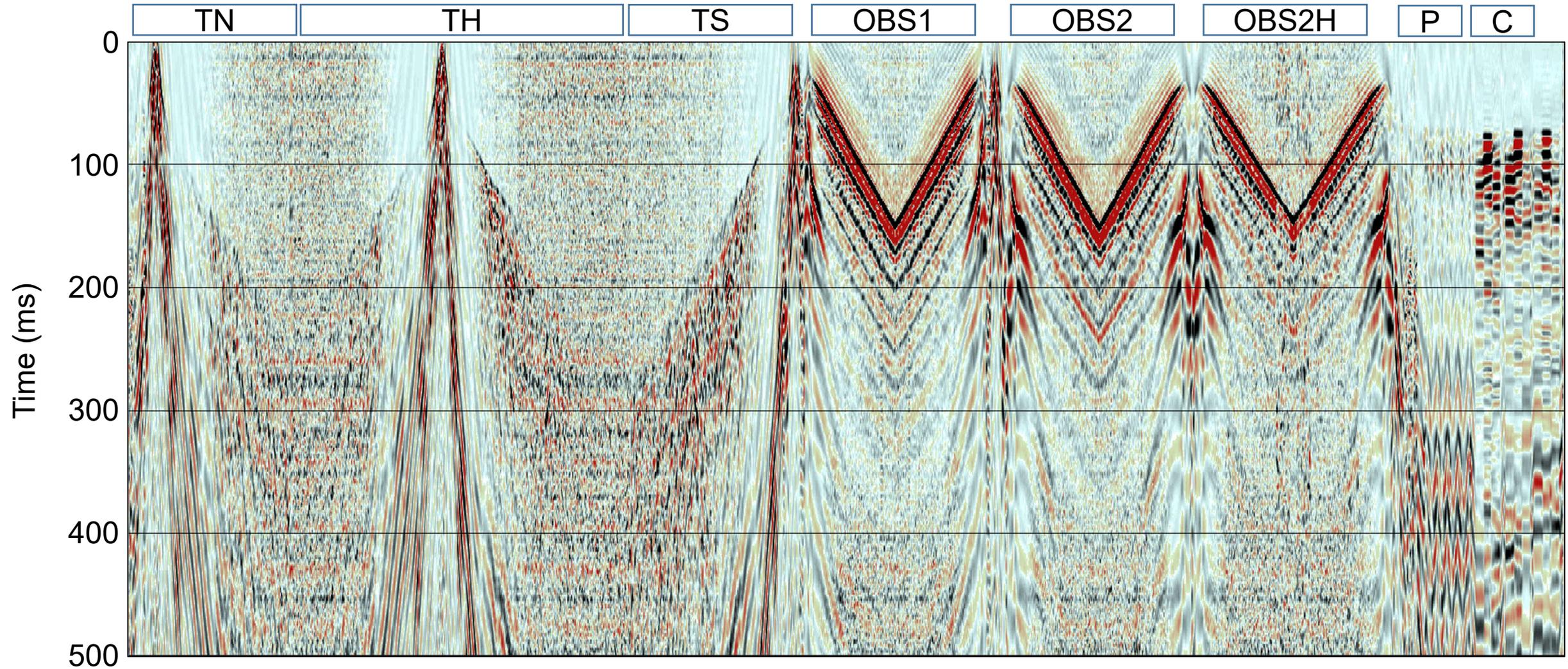
Croissant 2023: Field Tests; Geophone Locations





Croissant 2023: Field Tests; Stacked and Correlated DAS Data

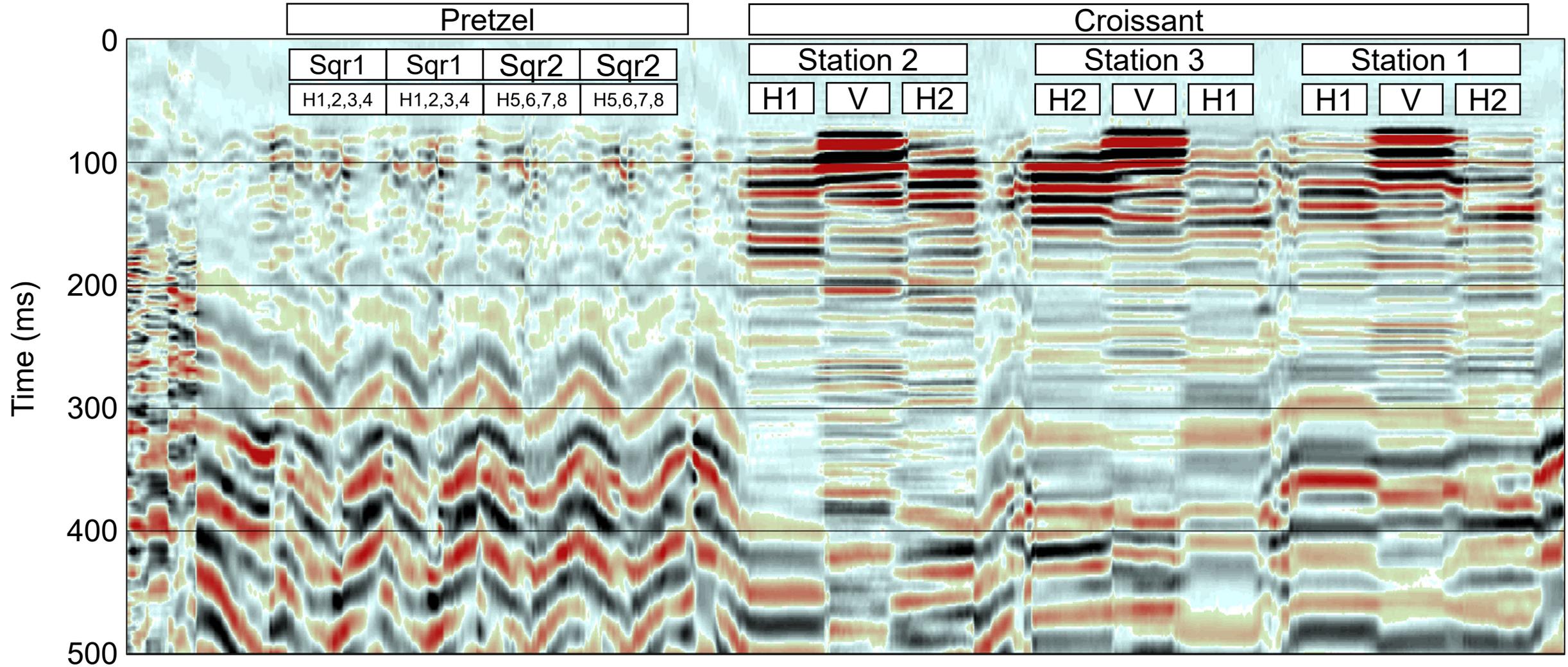
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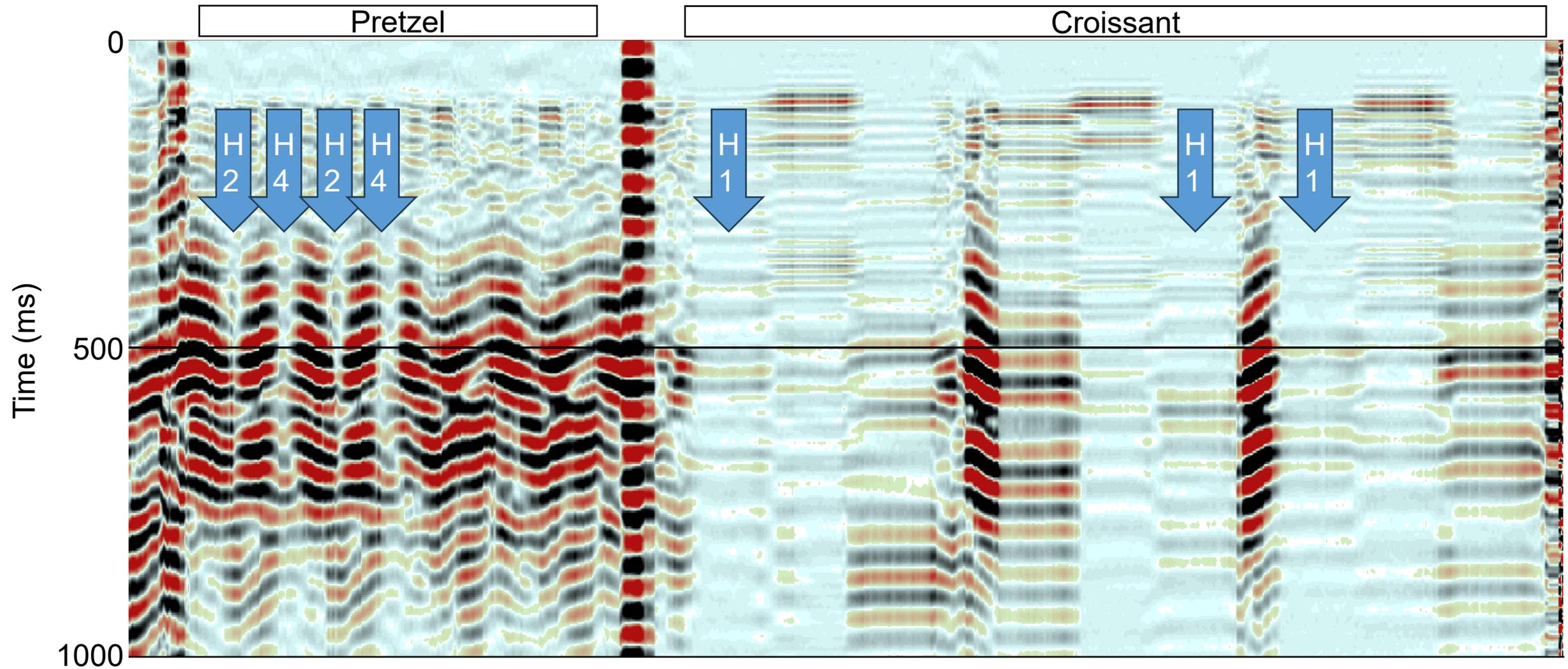
Croissant 2023: Field Tests; Stacked and Correlated DAS Data

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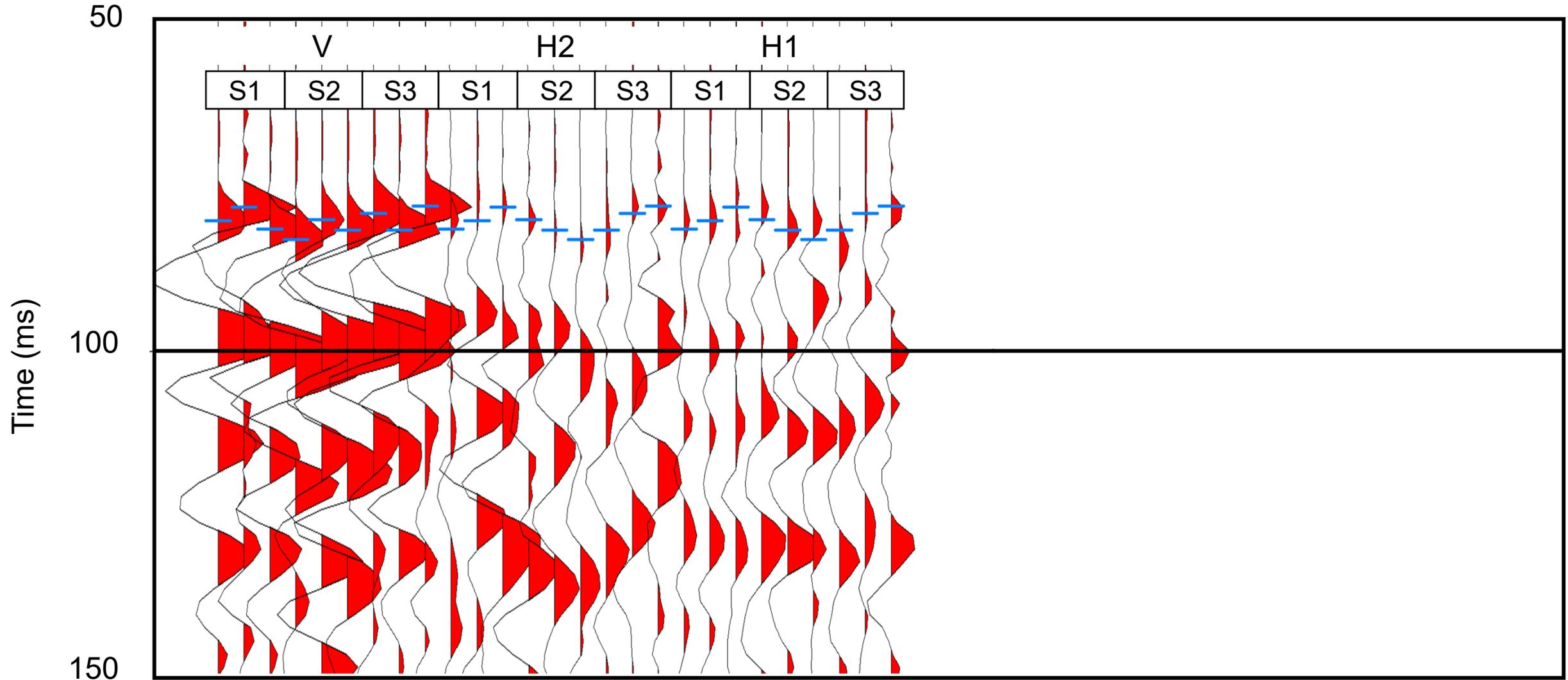
Croissant 2023: Field Tests; Nulls Due to Broadside Insensitivity





Croissant 2023: Field Tests; Stacked and Correlated Geophone Data

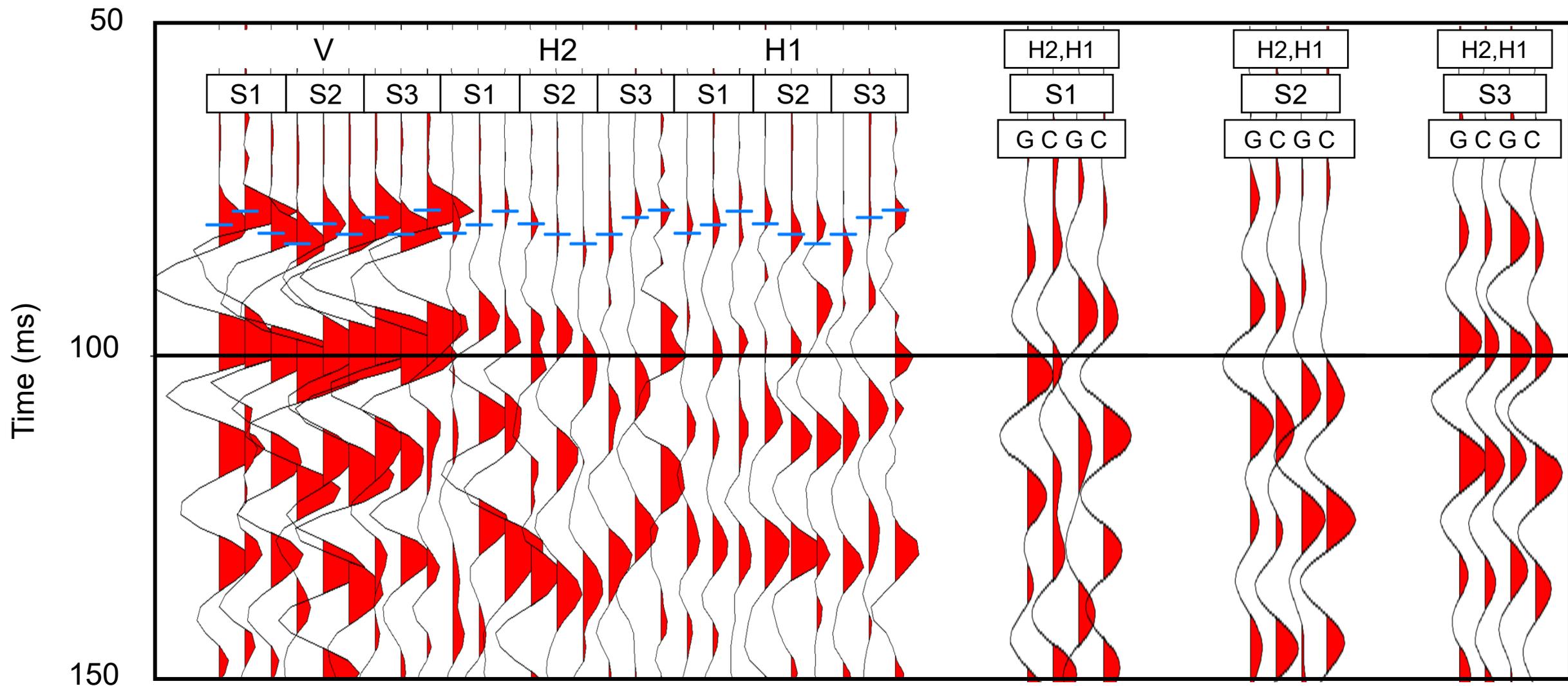
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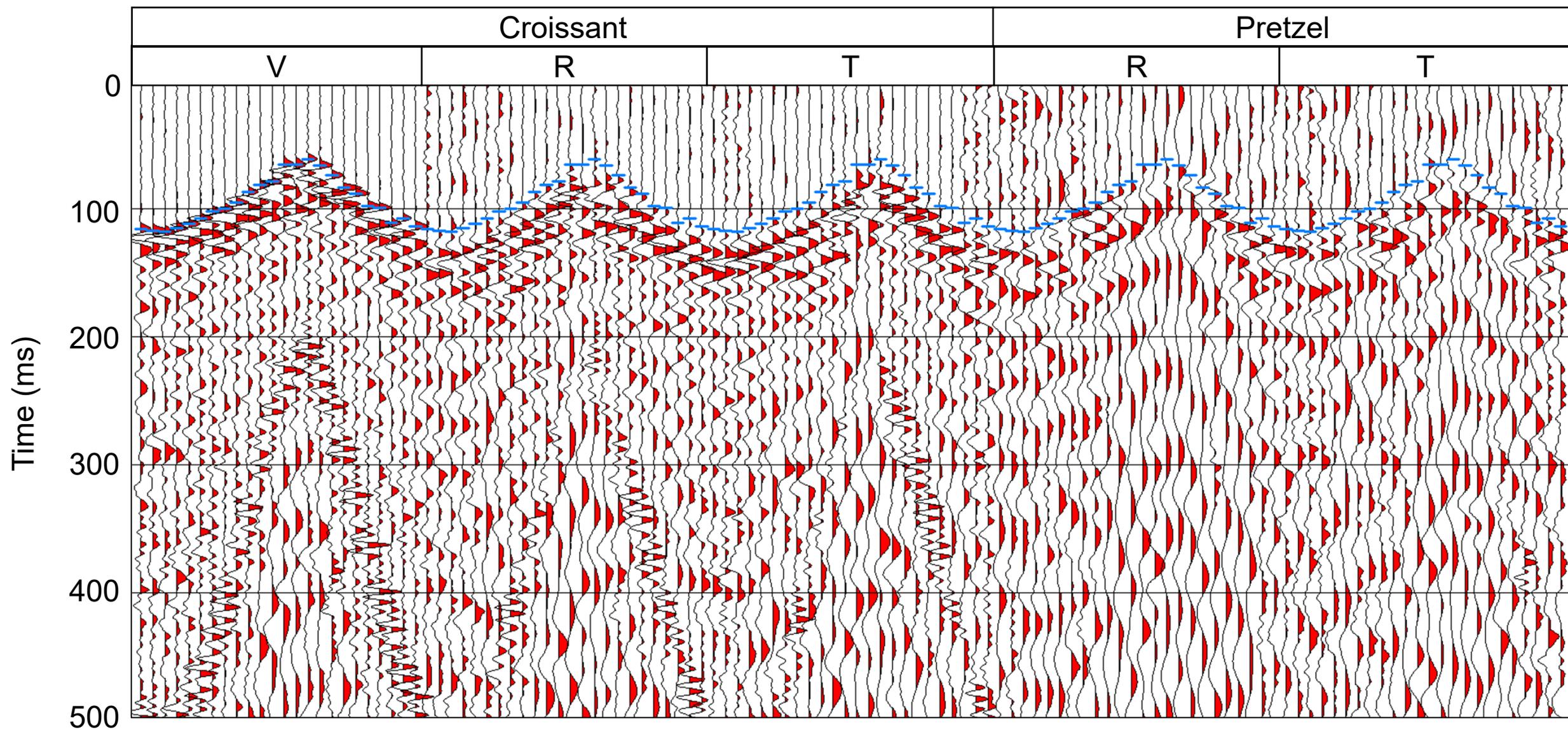
Croissant 2023: Field Tests; Geophone and DAS Data Comparison

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Field Tests; Croissant and Pretzel DAS Data Comparison





- Looks like seismic
- Comparable to Pretzel and geophone data
- Needs more field testing





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