Utah Forge
Monitored Well: 16B(78)-32

Circulation Test Period with fiber optics monitoring
Field Operations: Jul 2023
Processing: Sept – October 2023

Neubrex TGD DAS Data Review

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Last update: October 20, 2023

Fiber information

End of Fiber Cable:
Fiber termination info and depth received from Operator casing tally documents.

Table 2. Fiber termination depths

Name	KB, ft	Termination, ft BF	Fibers
16B(78)-32	31	10,108.46	SM/MM

There are 2 separate sensing cables installed on this well (names are after casing tally)
- **UT Shell cable (starts at 10,108.46 MD ft KB). This is the one used by Neubrex**
- Silixa cable (starts at 10,001.22 MD ft KB)

All measurements presented in this Report were made on UT **Shell** cable.

Measurement Units

The time zone and unit system

Measurement units

- Imperial (US) units are used in the report
  - Distance – foot, ft
  - Temperature – Fahrenheit degree, °F
  - Pressure – pound per square inch, psi

- Values of strain reported as micro-strain, µϵ
  - Unless stated otherwise

Time zone

- Results reported in this document are in ***Mountain Daylight Time (MDT)***

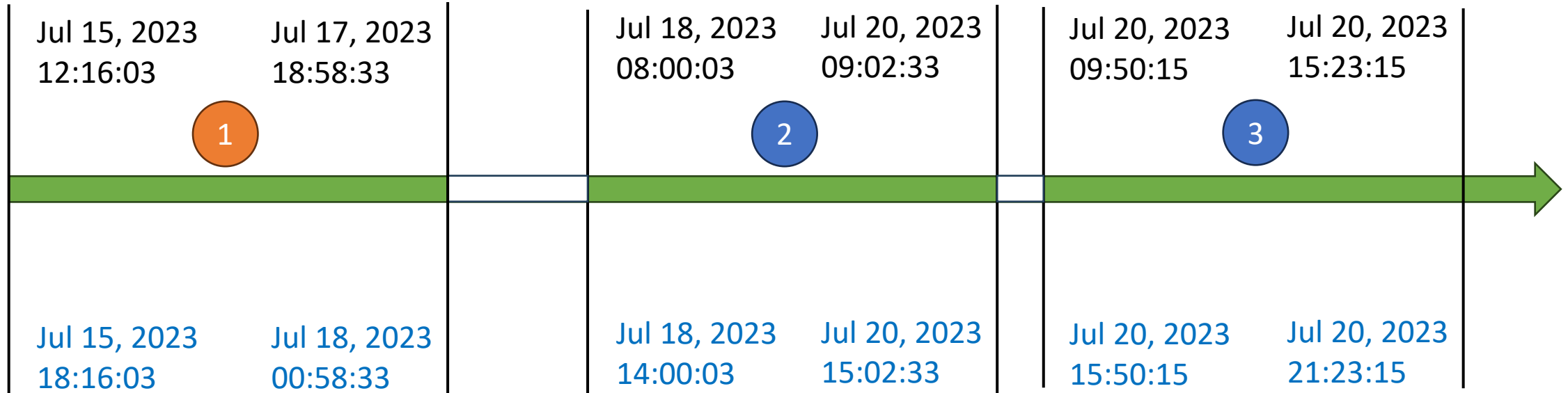- Local time zone was ***Mountain Daylight Time (MDT)***
  - UTC Offset: UTC −6

MDT time zone
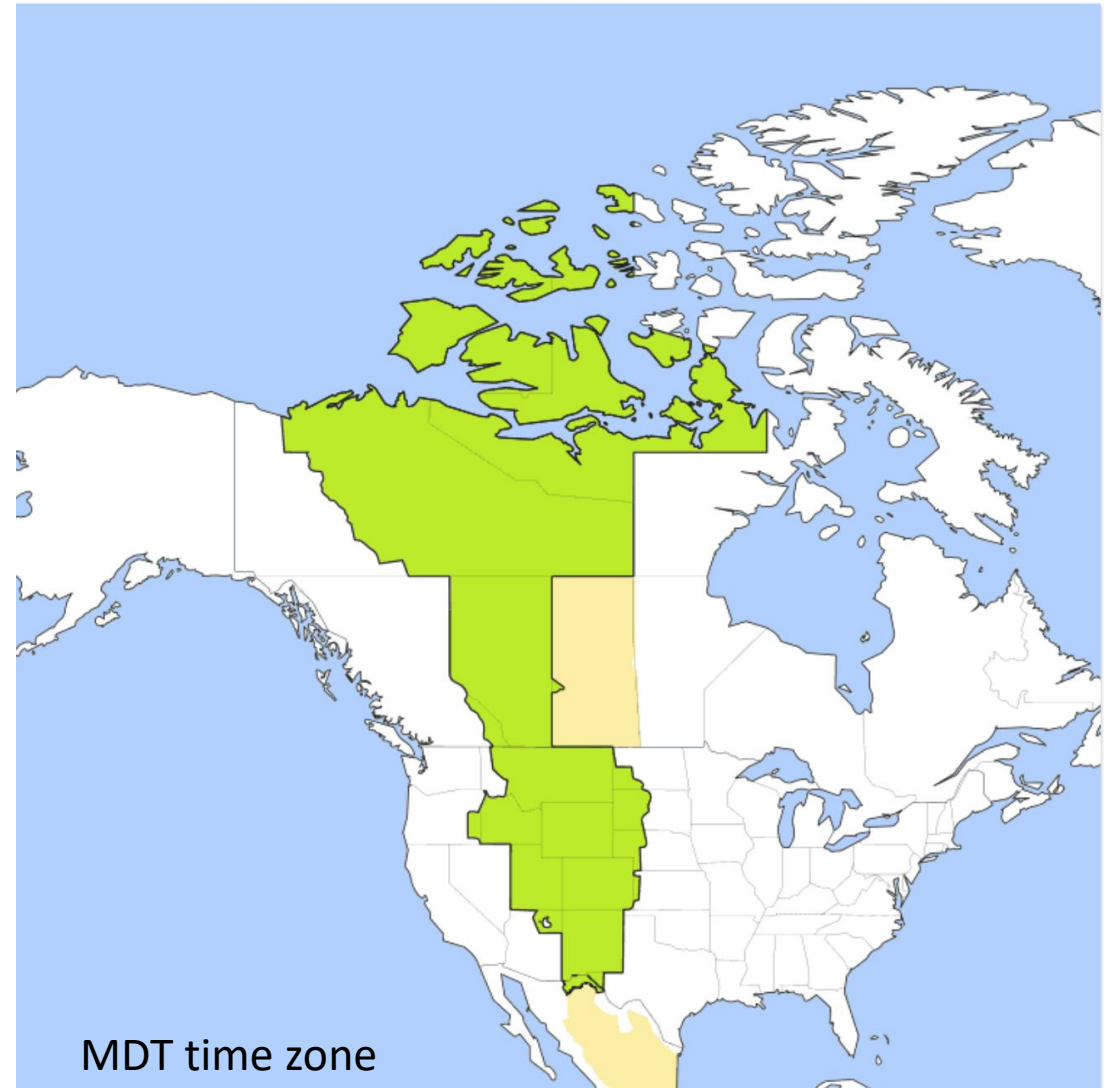
Time Gated Digital Distributed Acoustic Sensing (DAS) Acquisition

Neubrex NBX-S4000 was used on Single Mode Fiber. Raw data stored, allows spatial resolution and gauge length changes to be made (a posteriori).

DAS acquisition timeline during FORGE "evo 0" and "evo 1"

MDT - Local time (offset to UTC = - 06:00)

Jul 15, 2023 12:16:03 — Jul 17, 2023 18:58:33 (marker 1)

Jul 18, 2023 08:00:03 — Jul 20, 2023 09:02:33 (marker 2)

Jul 20, 2023 09:50:15 — Jul 20, 2023 15:23:15 (marker 3)

Jul 15, 2023 18:16:03 — Jul 18, 2023 00:58:33

Jul 18, 2023 14:00:03 — Jul 20, 2023 15:02:33

Jul 20, 2023 15:50:15 — Jul 20, 2023 21:23:15

UTC

DAS acquisition and processing parameters

- Spatial resolution: 1.5 meters upon decoded ouput and resample

- Native raw Spatial sampling interval from Interrogator Unit: 0.2 m

- Temporal sampling interval:
  - Part 1: **2 kS/s (2000 Hz)**
  - Parts 2 and 3: **10 kS/s (10,000 Hz)**

- Output type:
  - **Strain rate**

- Raw data stored
  - Able to modify both spatial resolution and gauge length

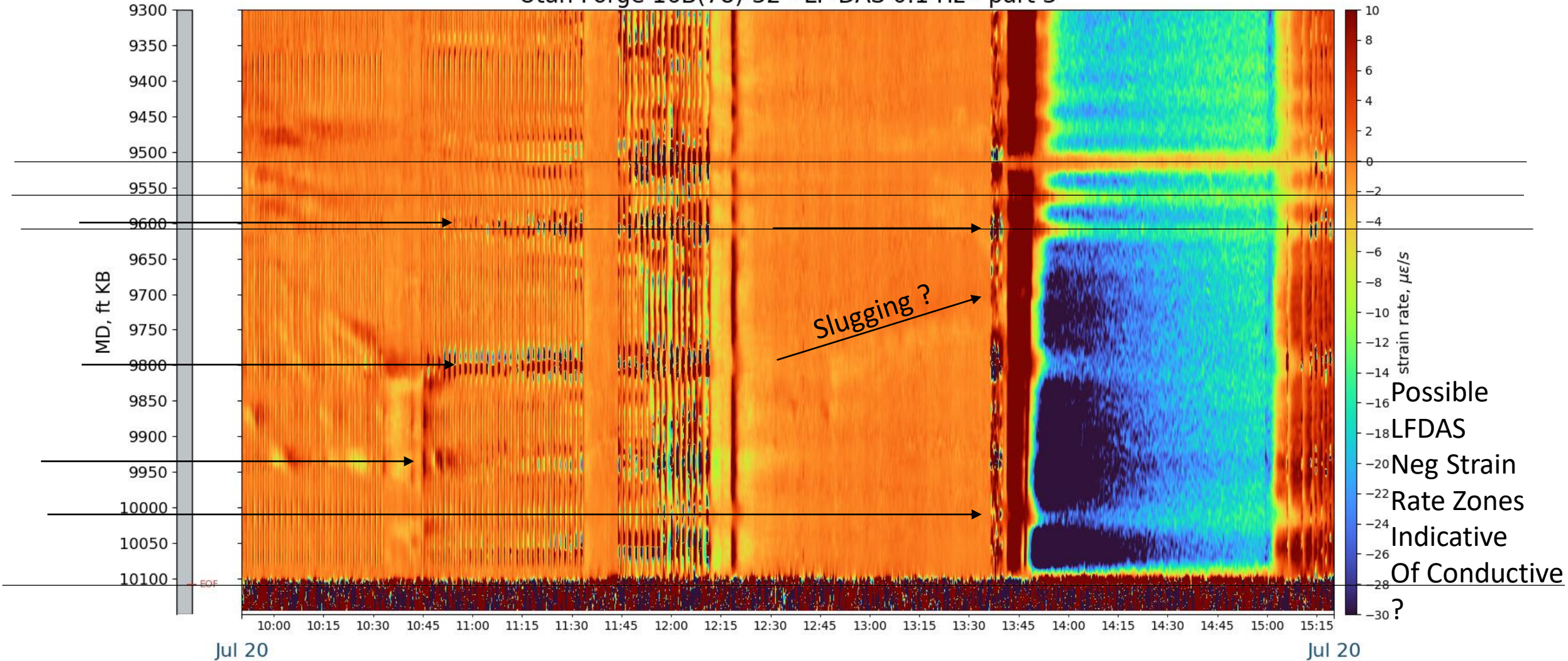# LF-DAS = Low Frequency DAS extraction for full band DAS

Utah Forge 16B(78)-32 - LF-DAS 0.1 Hz - part 3
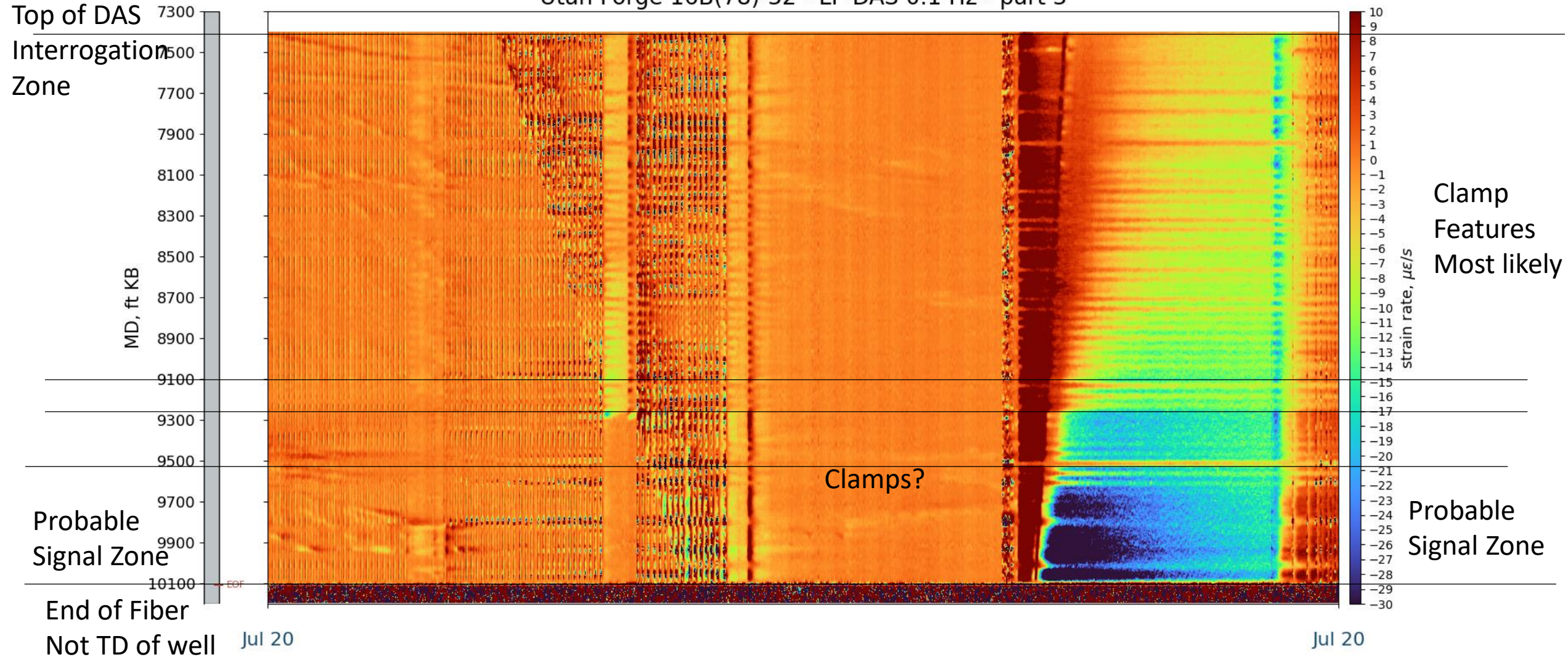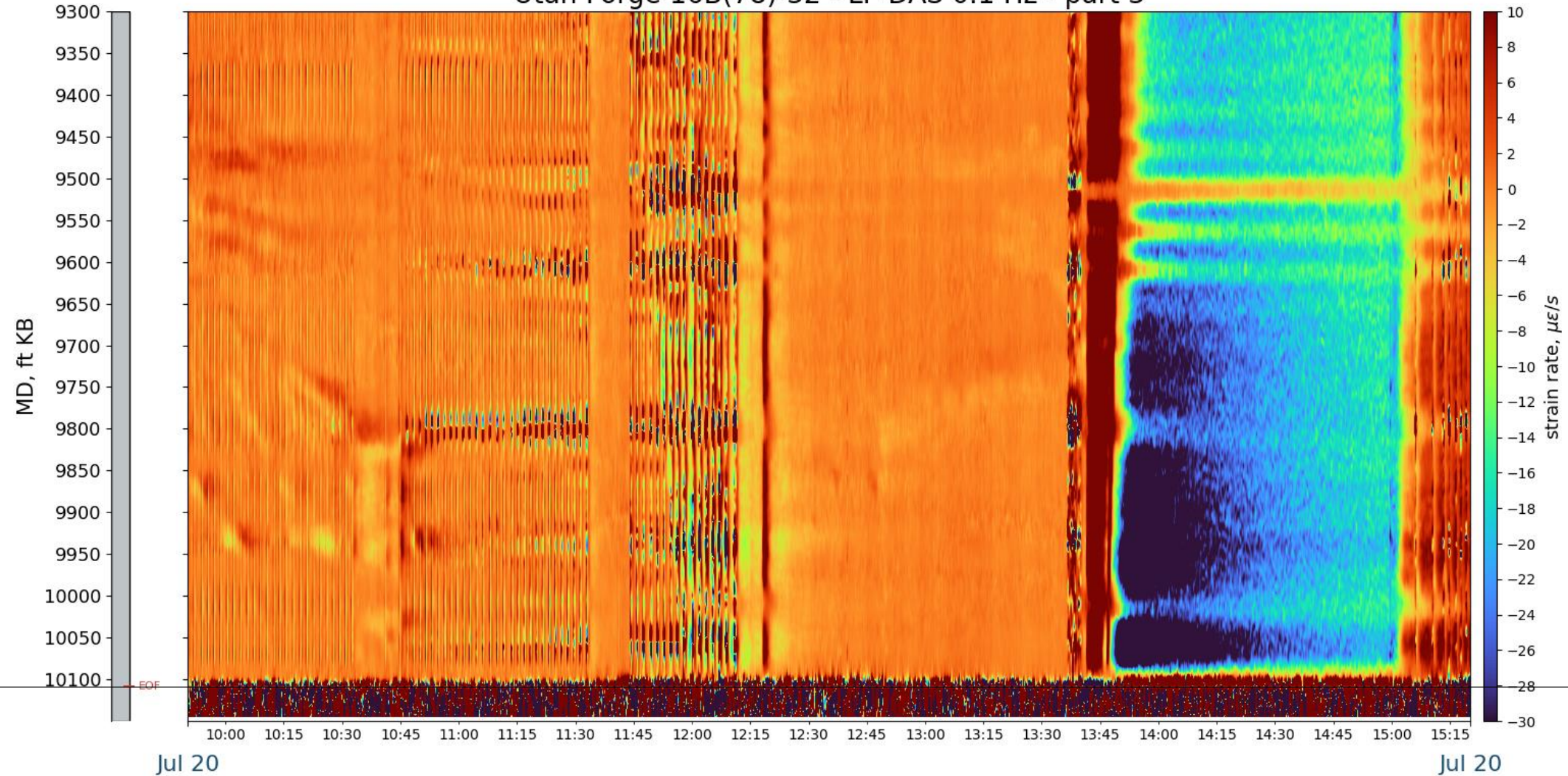
Utah Forge 16B(78)-32 - LF-DAS 0.1 Hz - part 3

Utah Forge 16B(78)-32 - LF-DAS 0.1 Hz - part 3

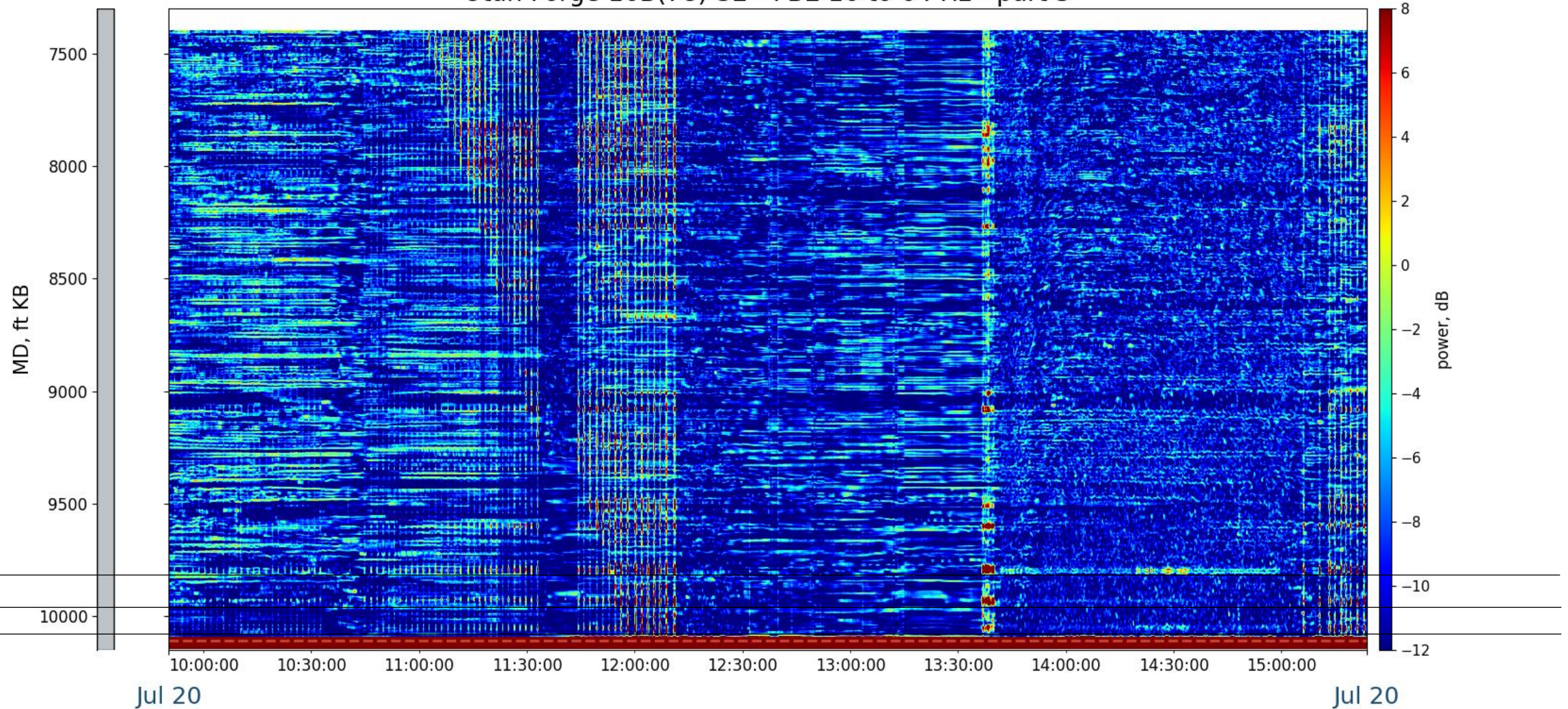# FBE Frequency Band Extraction 4 – 16 Hz (2 Octave band)

Utah Forge 16B(78)-32 - FBE 4 to 16 Hz - part 3
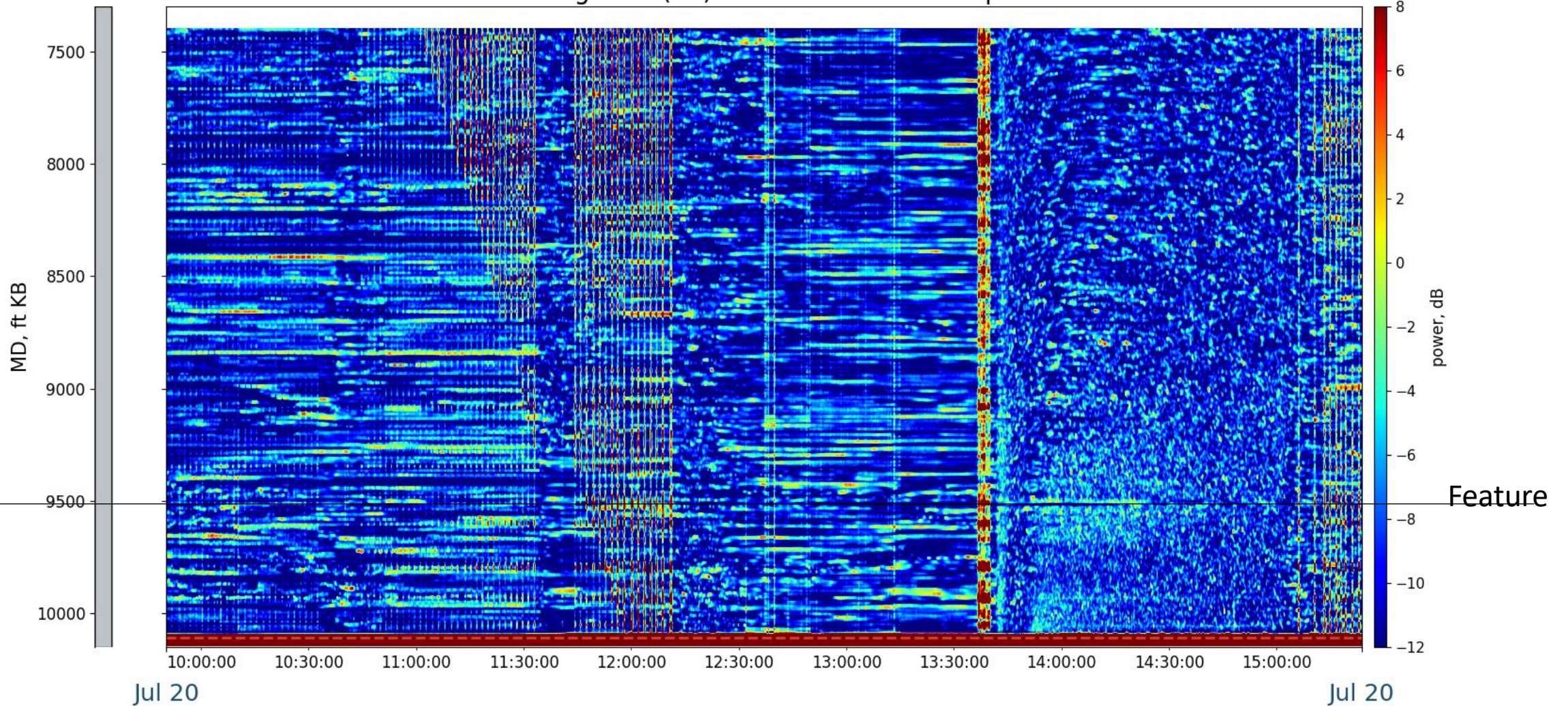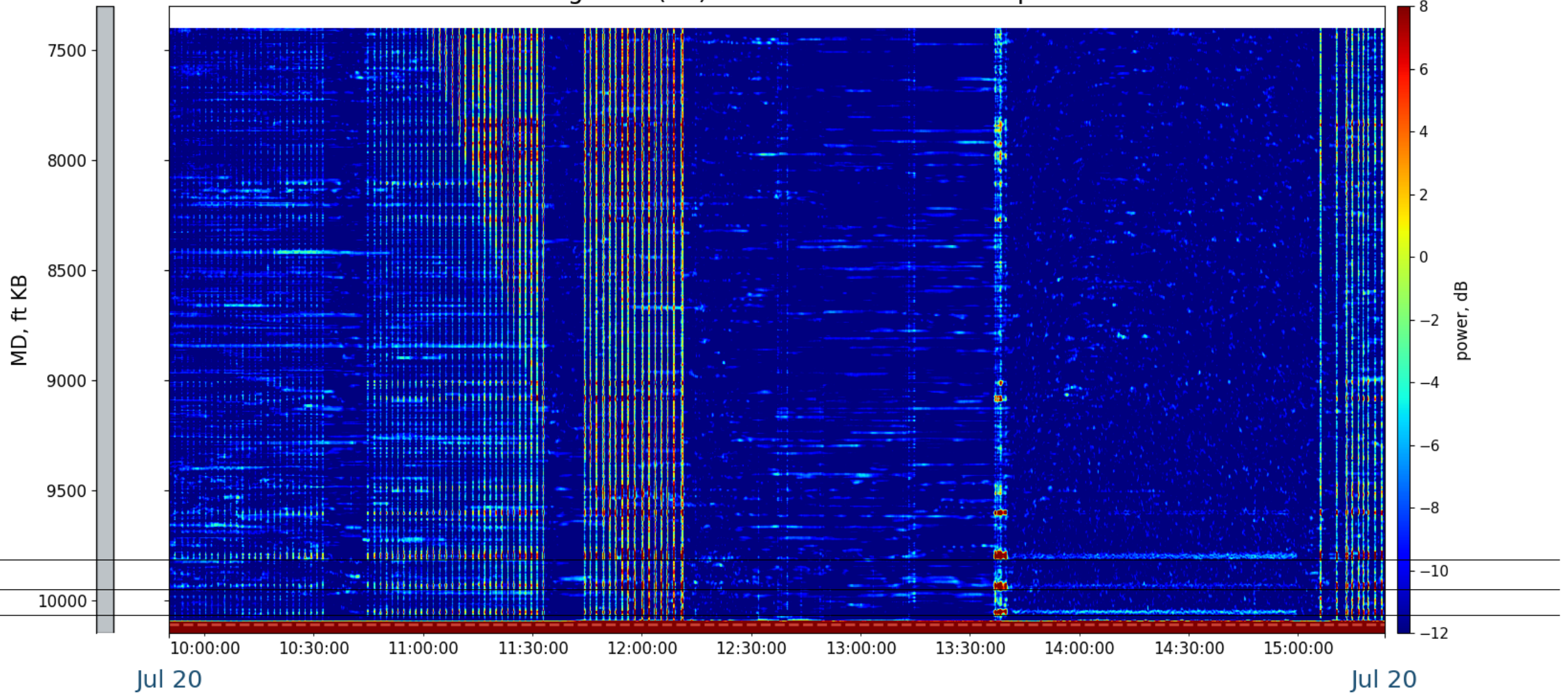
FBE 16 to 64 Hz (2 Octave band)

Utah Forge 16B(78)-32 - FBE 16 to 64 Hz - part 3
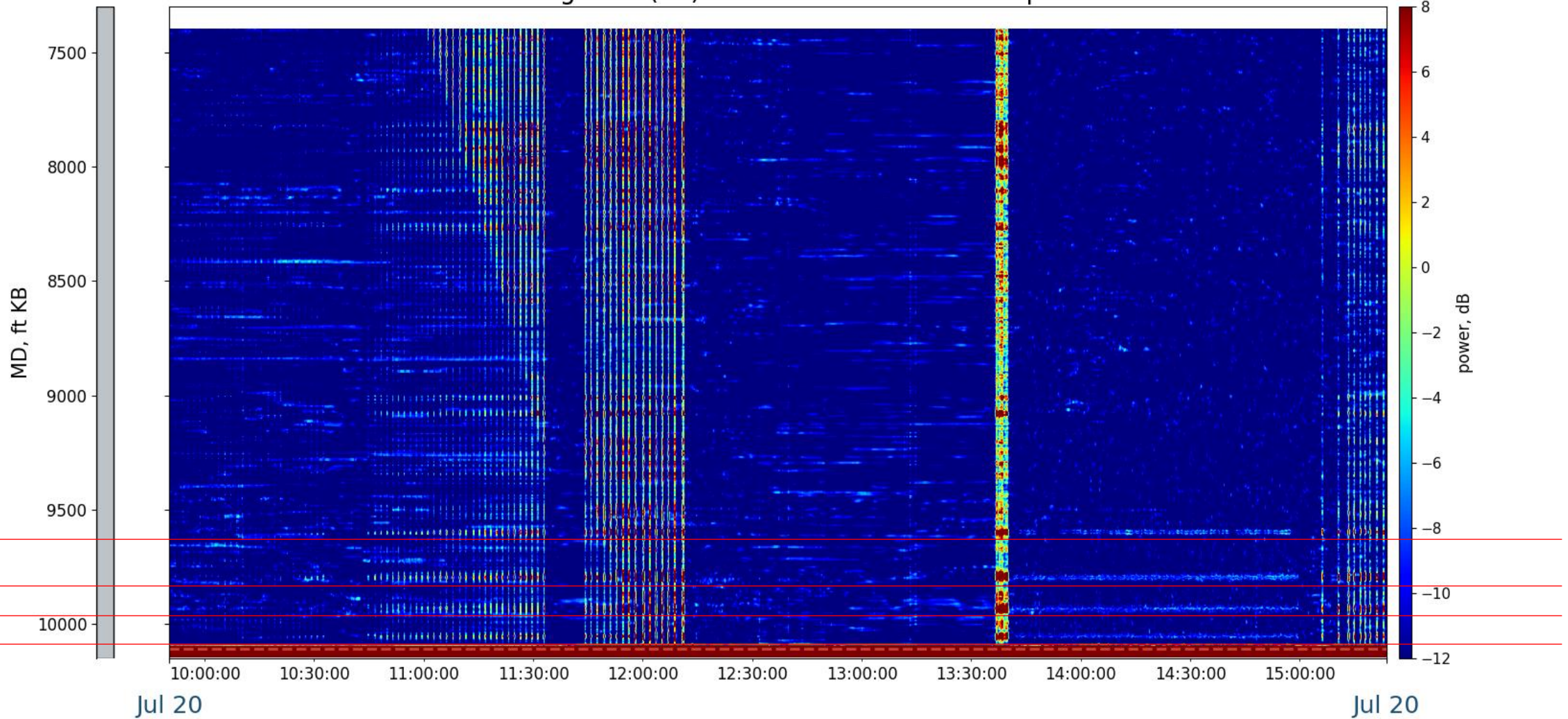
FBE 64 - 256 Hz (2 Octave band)

Utah Forge 16B(78)-32 - FBE 64 to 256 Hz - part 3
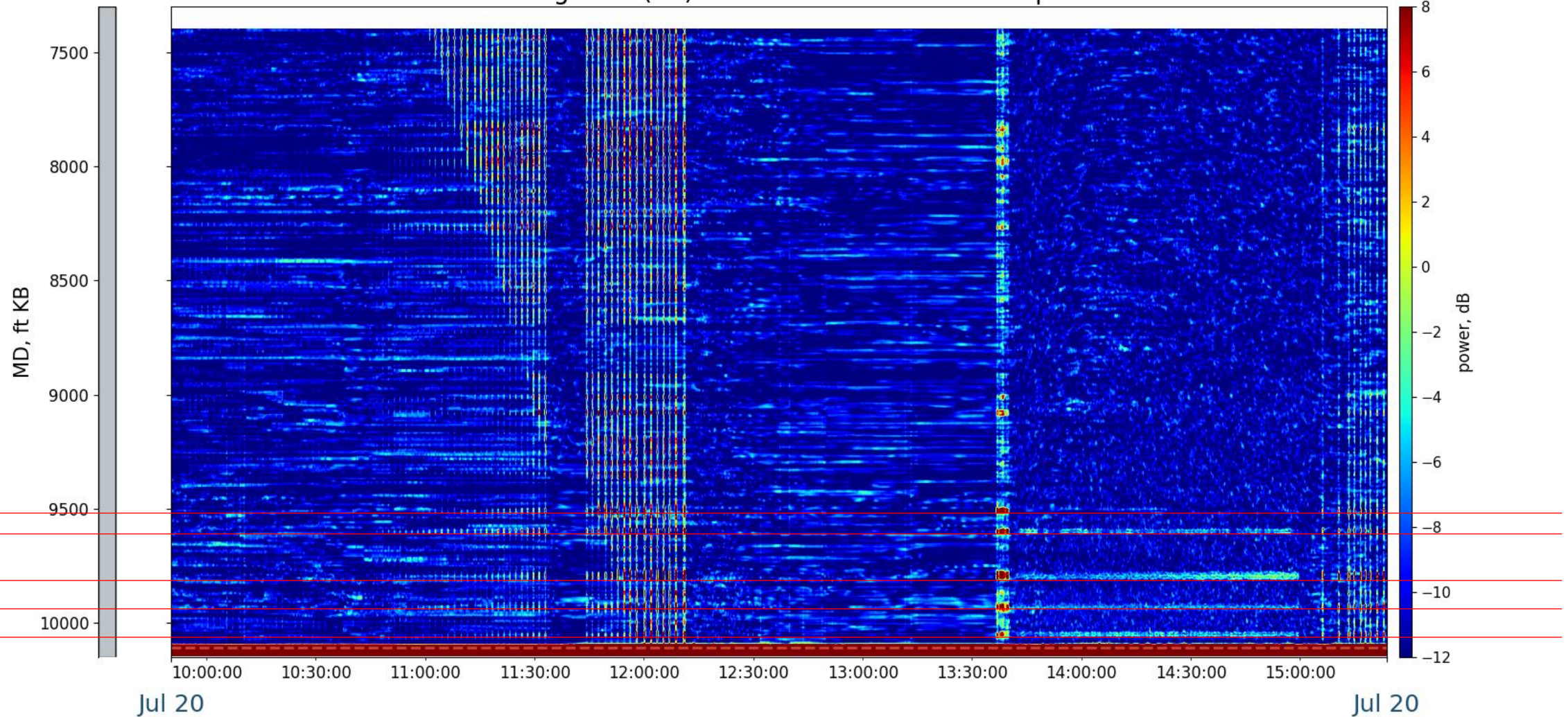
FBE 256 – 512 Hz (1 Octave band)

Utah Forge 16B(78)-32 - FBE 256 to 512 Hz - part 3

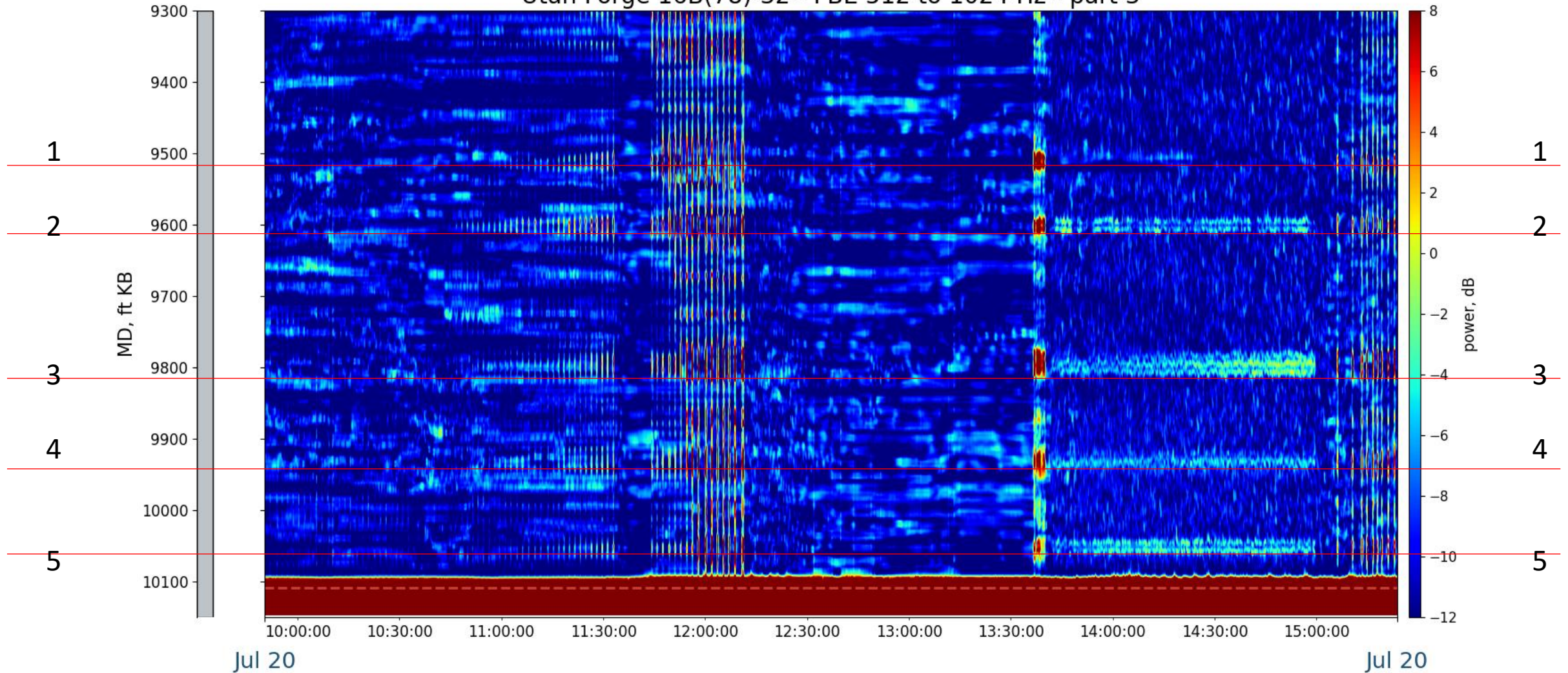# FBE 512 – 1024 Hz (1 Octave band) Best Band to See Features

Utah Forge 16B(78)-32 - FBE 512 to 1024 Hz - part 3

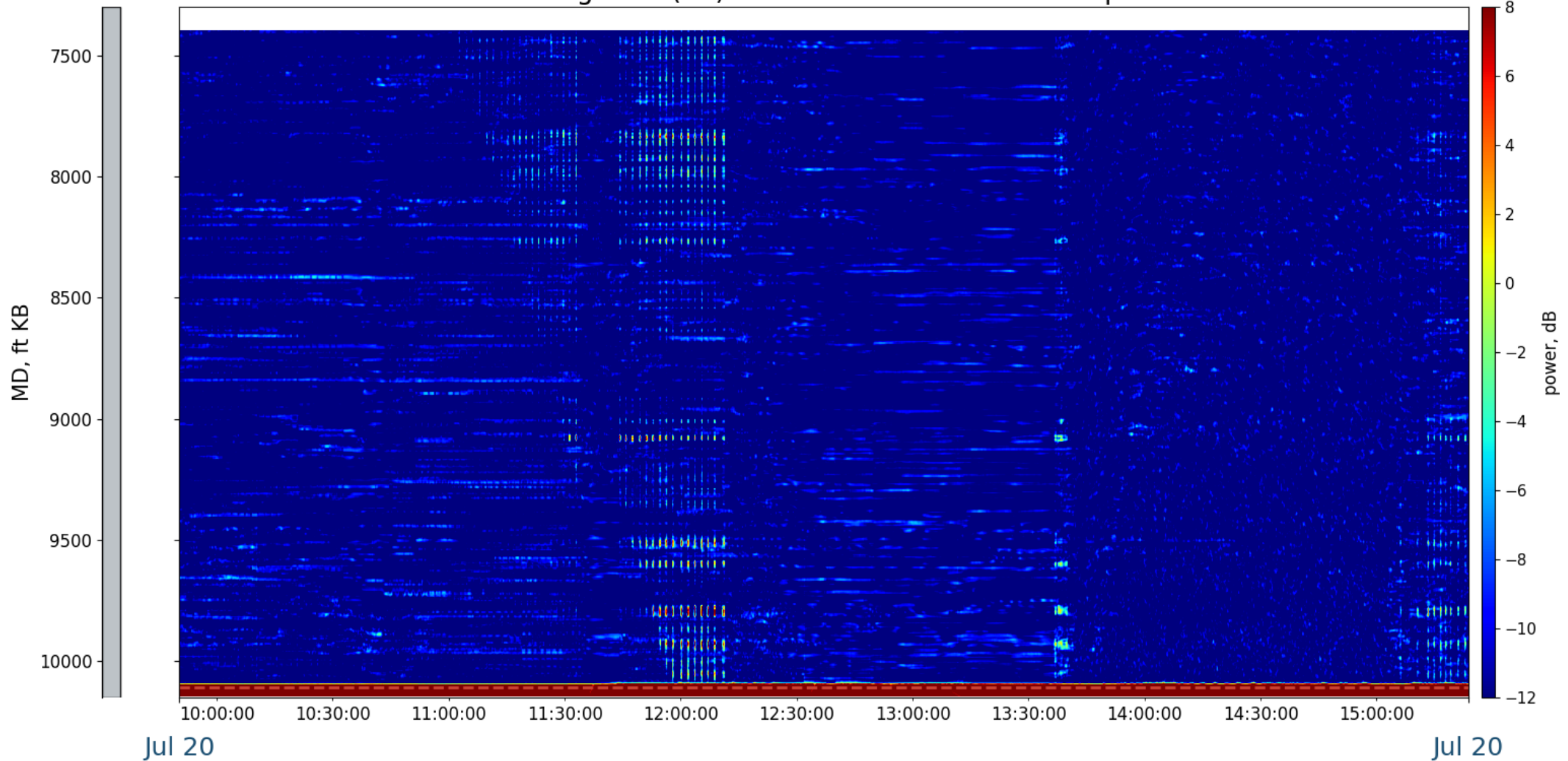# FBE 512 – 1024 Hz (zoomed in) to features of interest

Utah Forge 16B(78)-32 - FBE 512 to 1024 Hz - part 3

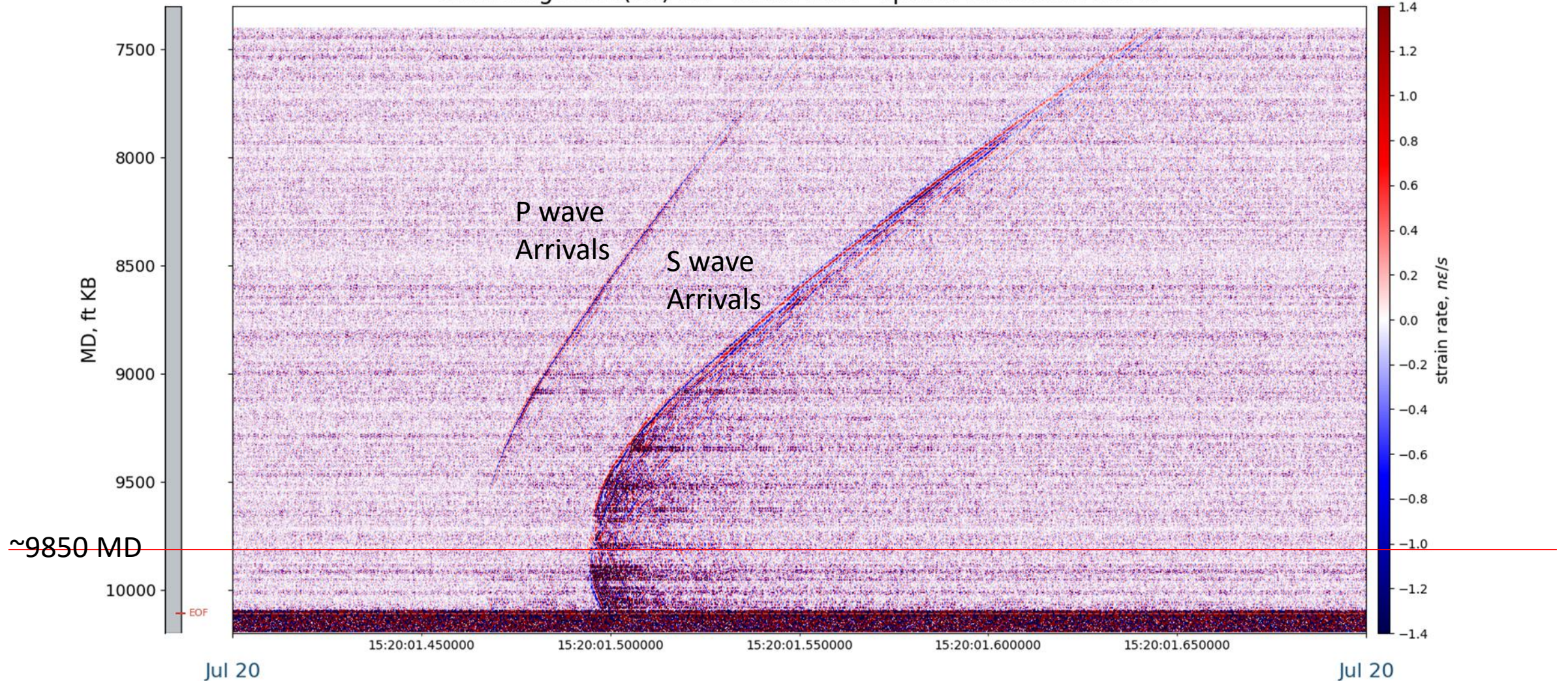# FBE 1024 – 4096 (2 Octave band) not much visible

Utah Forge 16B(78)-32 - FBE 1024 to 4096 Hz - part 3

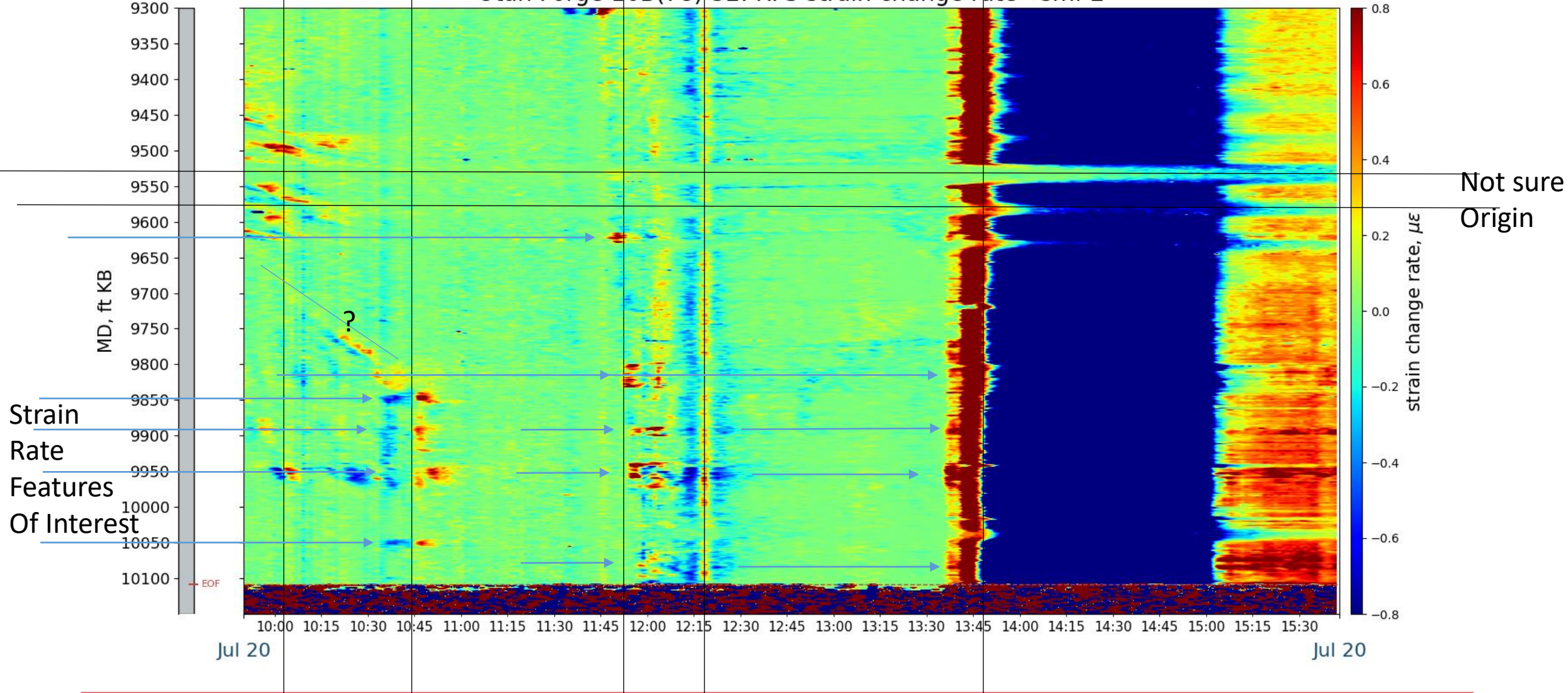# MS Event extracted from the Full Band DAS –Note Apex Depth

Utah Forge 16B(78)-32 - strain rate - spatial resolution 1.5 m

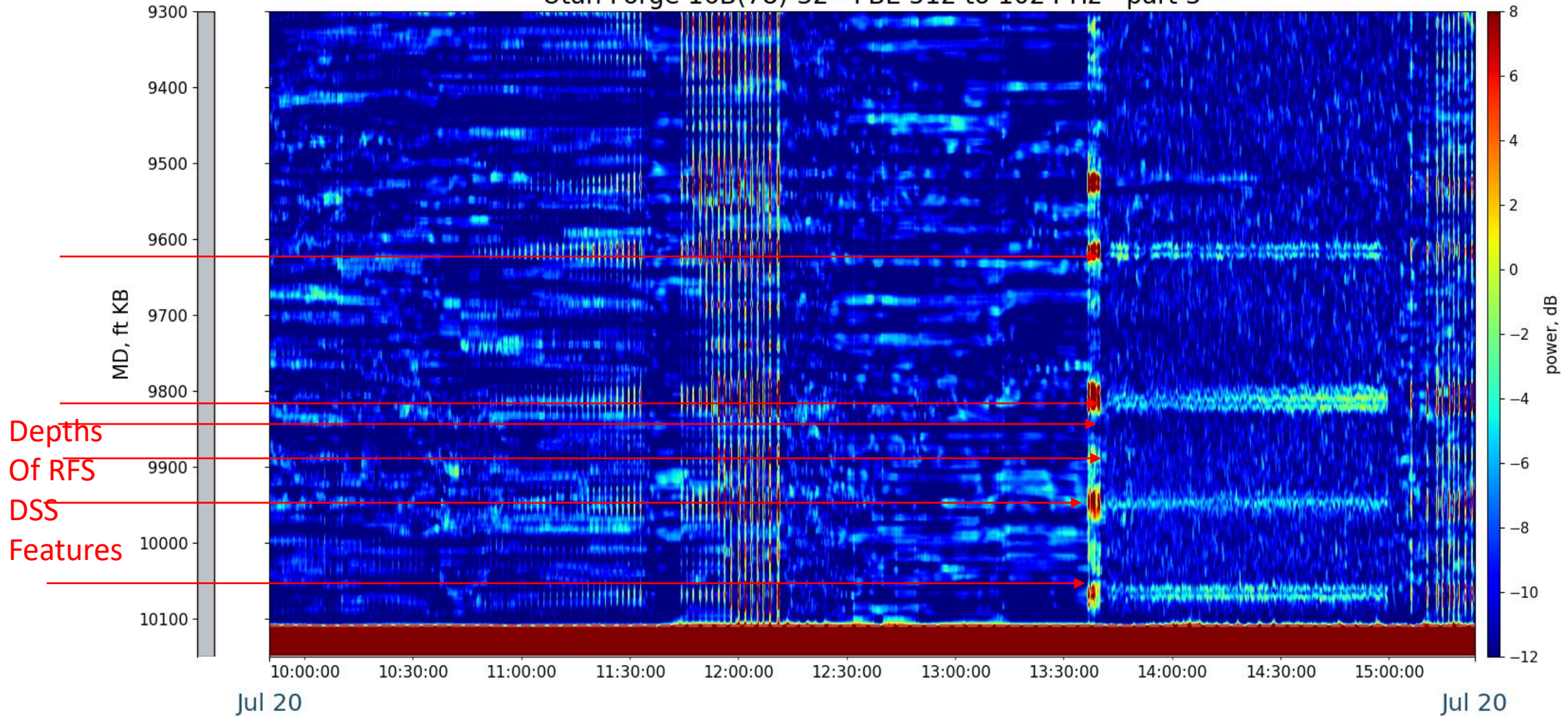# RFS DSS Strain Change Rate (Quasi static strain rate data RFS)

Utah Forge 16B(78)-32: RFS strain change rate - smf 2

Not sure Origin

Strain Rate Features Of Interest

Utah Forge 16B(78)-32 - FBE 512 to 1024 Hz - part 3

Depths Of RFS DSS Features

Utah Forge 16B(78)-32 - LF-DAS 0.1 Hz and RFS strain rate - part 3
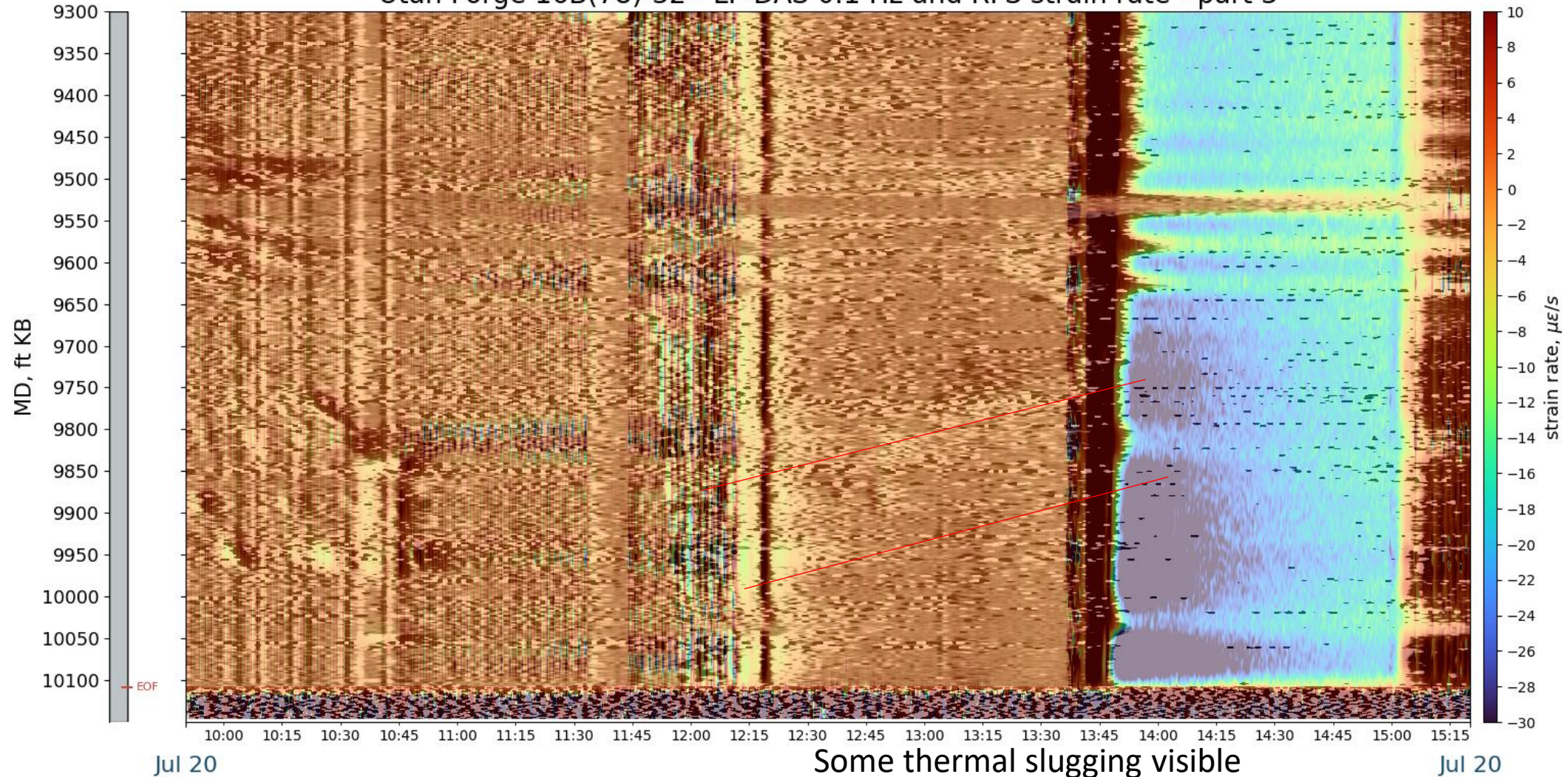
Some thermal slugging visible
In the color LF DAS background