

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

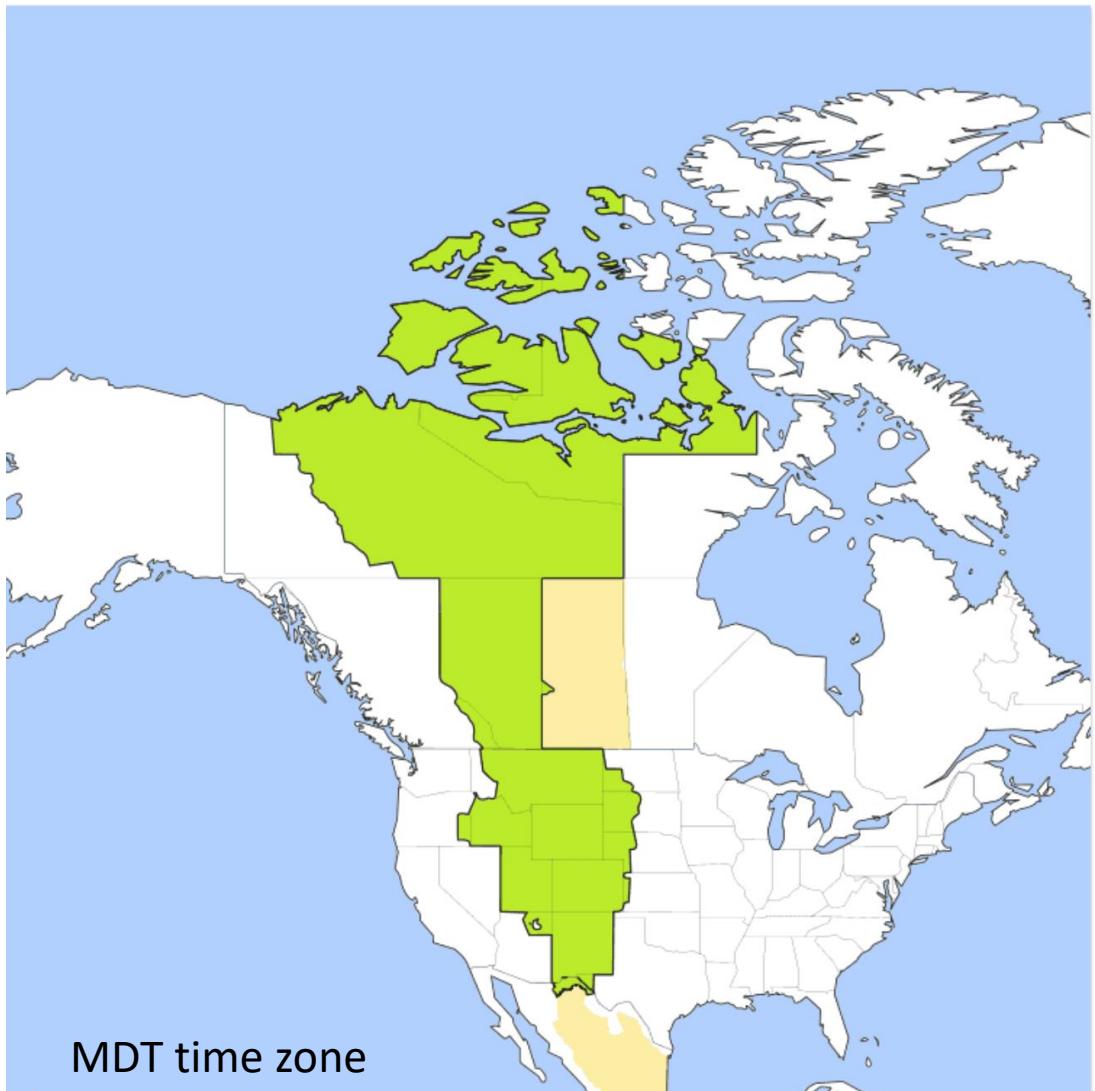
The time zone and unit system

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, $\mu\epsilon$
 - 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





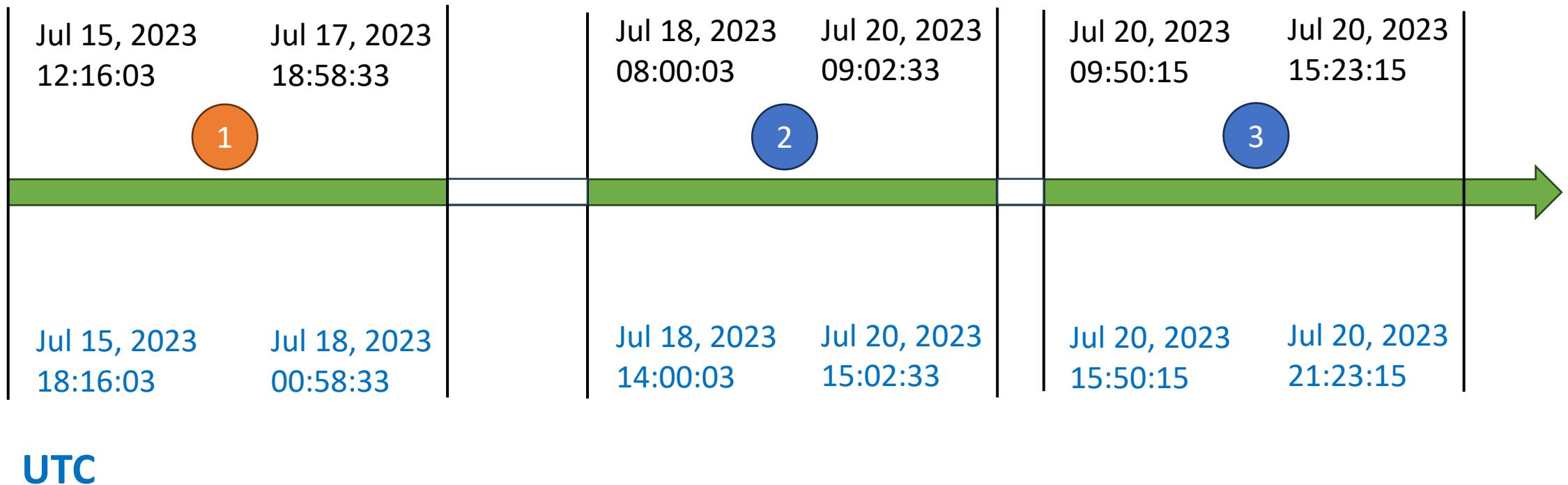
Time Gated Digital Distributed Acoustic Sensing (DAS) Acquisition

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”



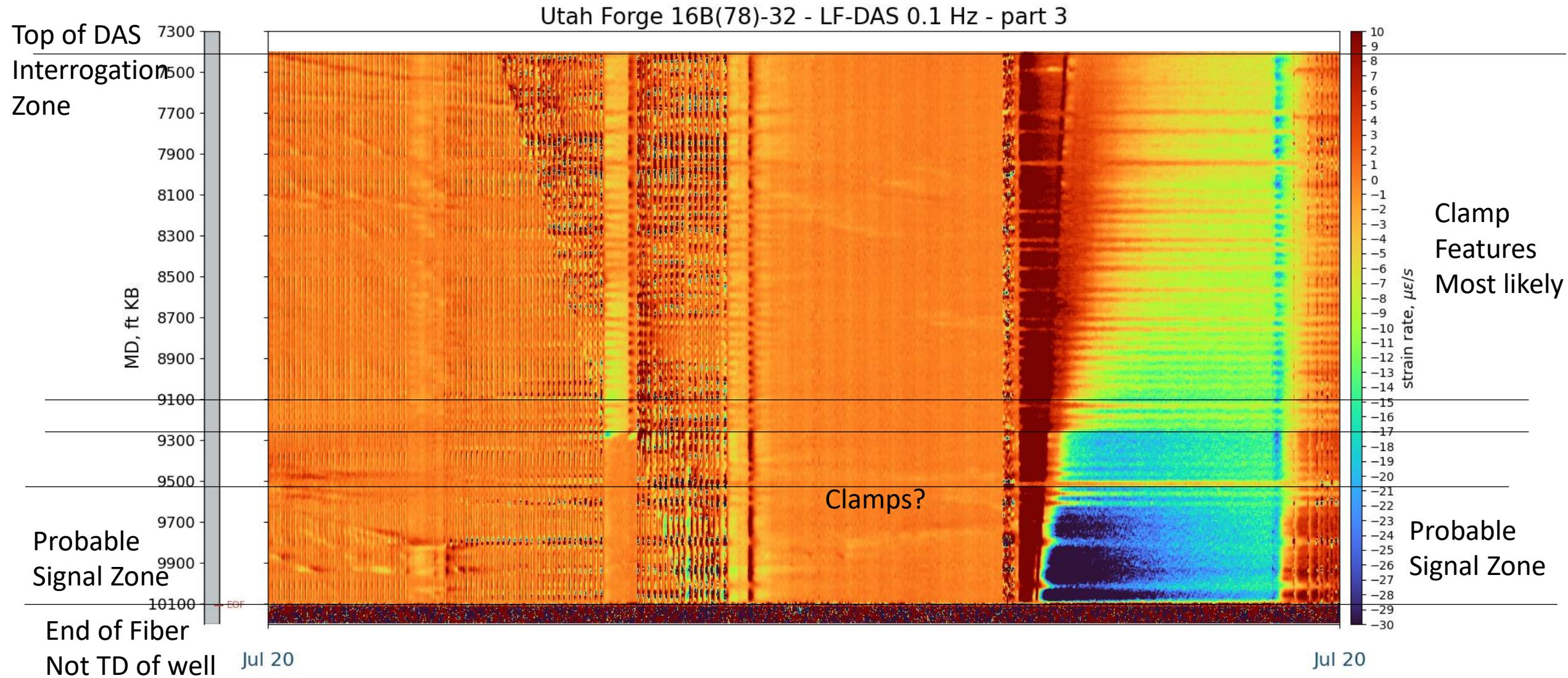
MDT - Local time (offset to UTC = - 06:00)



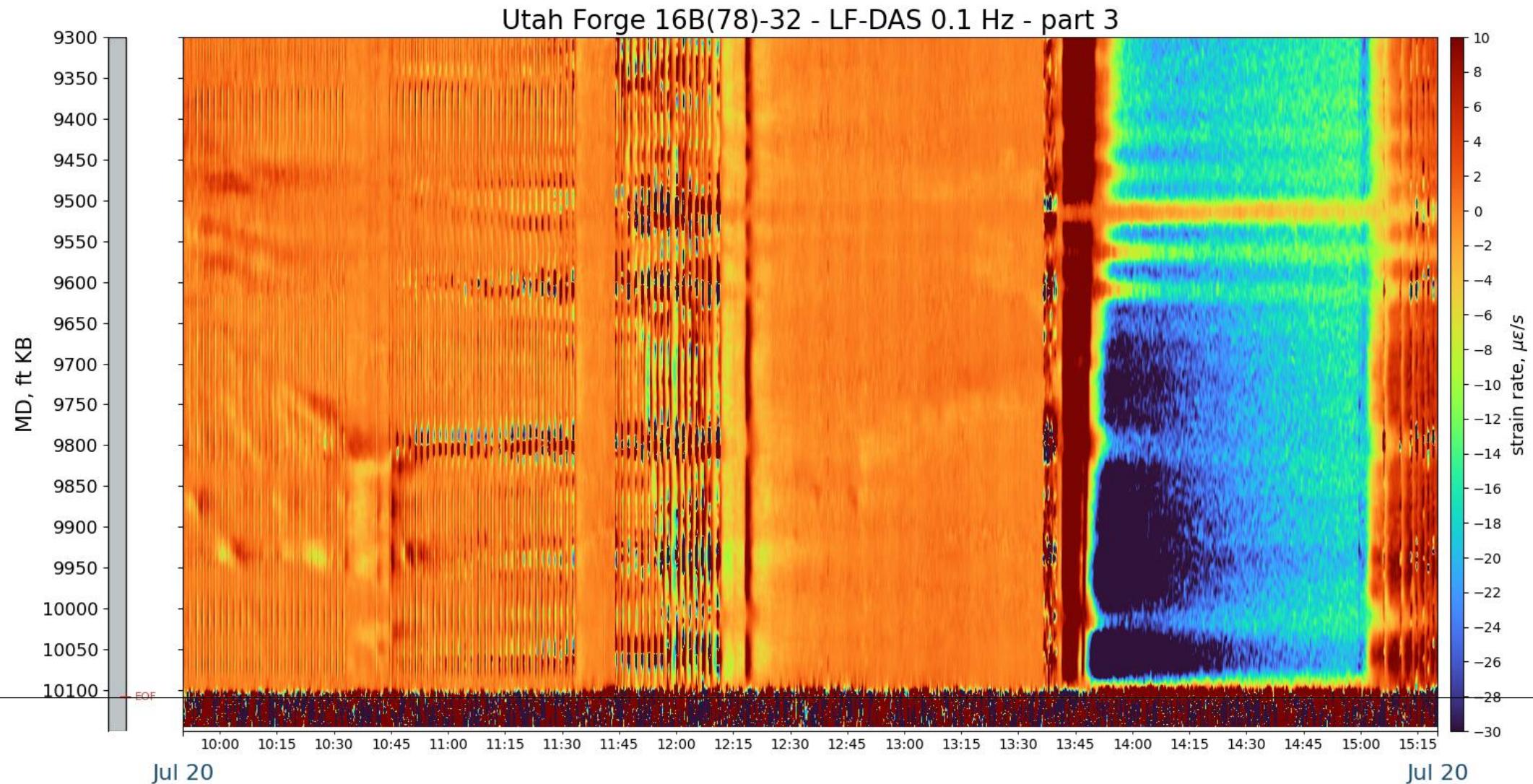
DAS acquisition and processing parameters

- Spatial resolution: 1.5 meters upon decoded output 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

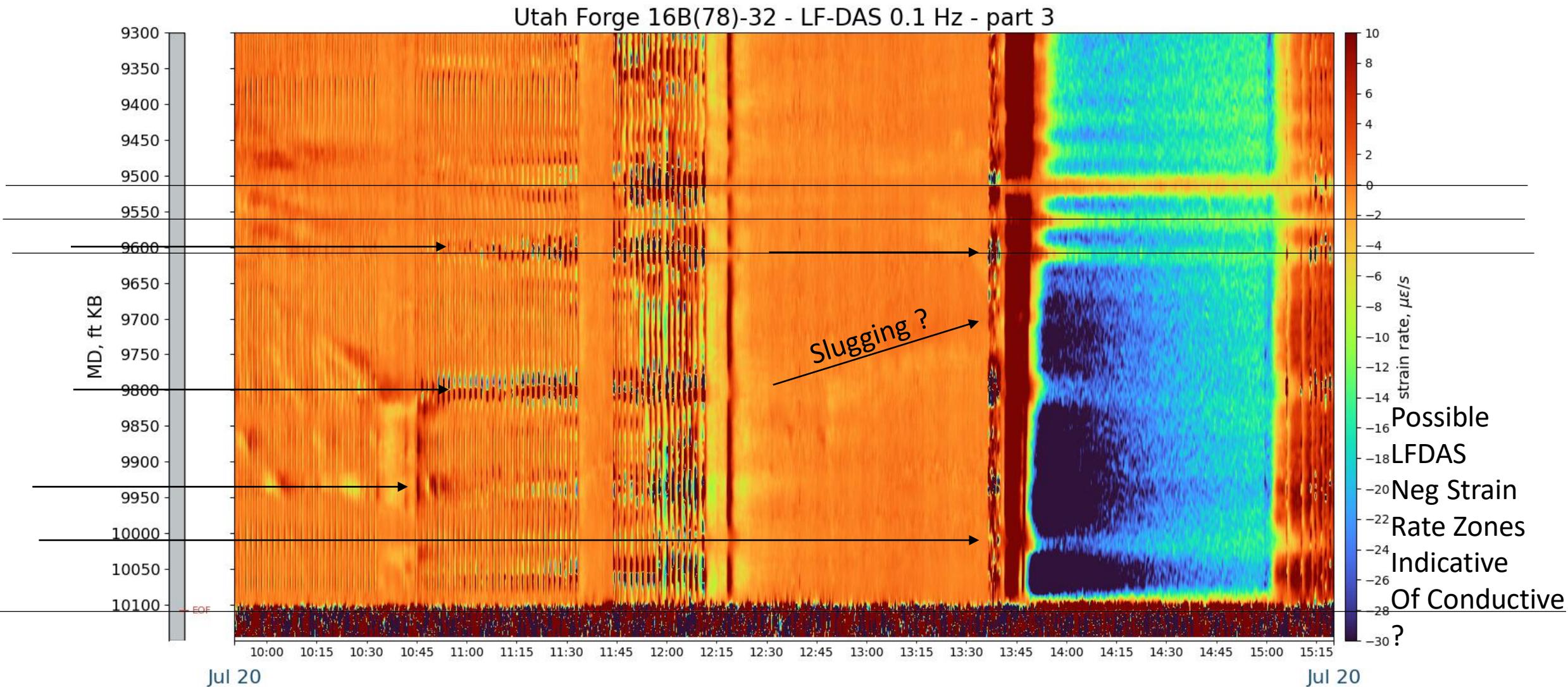
LF-DAS = Low Frequency DAS extraction for full band DAS



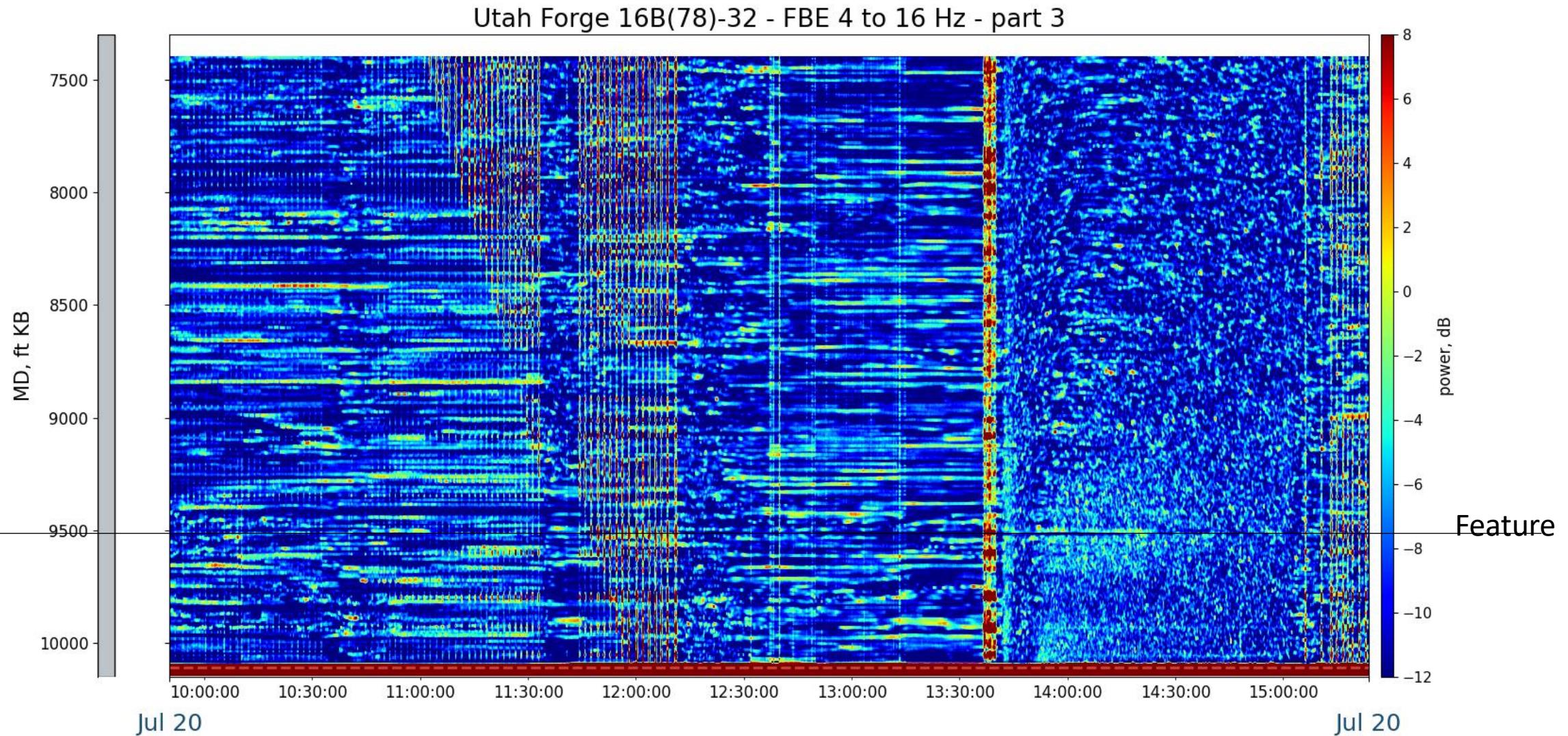
LF-DAS Zoomed into Region of Interest



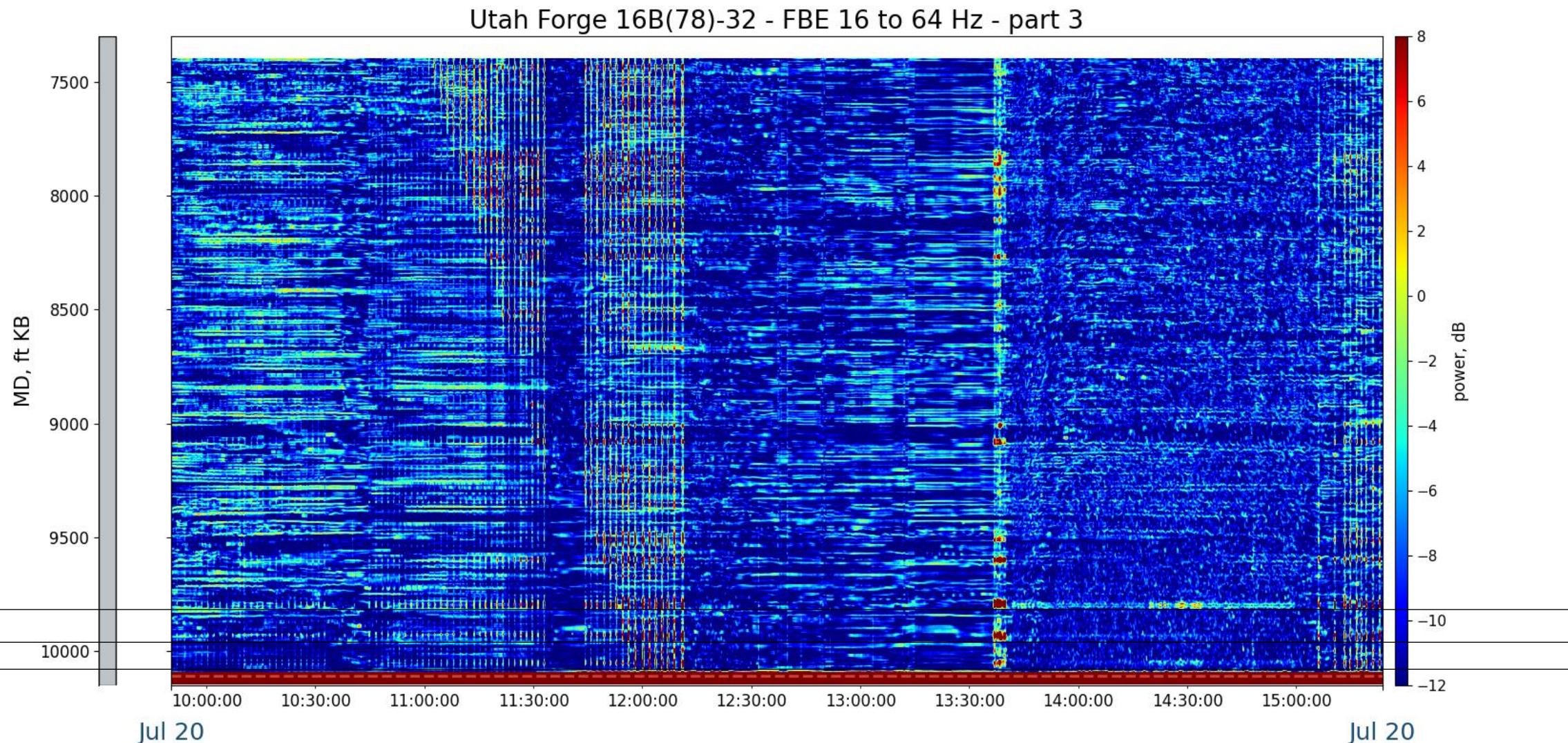
LF-DAS Zoomed into Region of Interest annotated



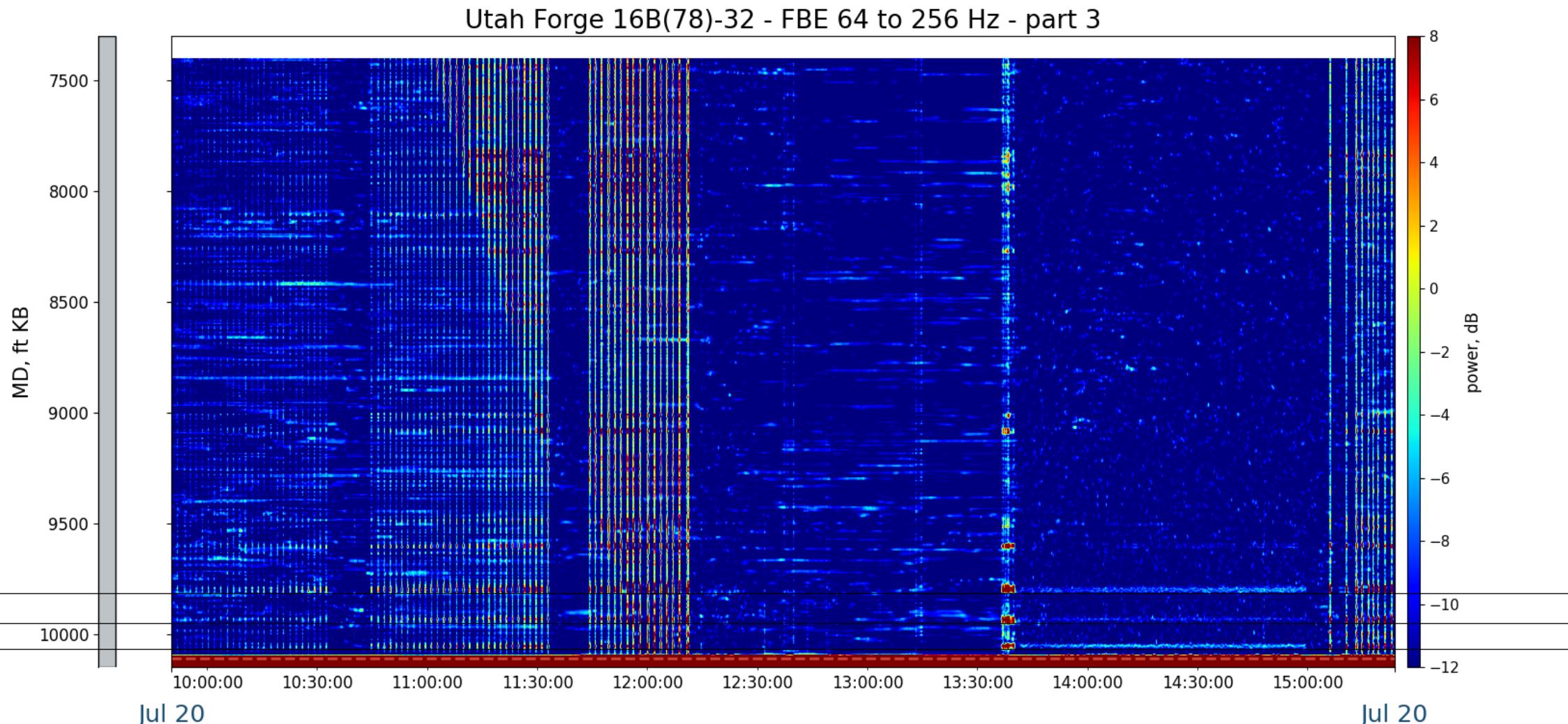
FBE Frequency Band Extraction 4 – 16 Hz (2 Octave band)



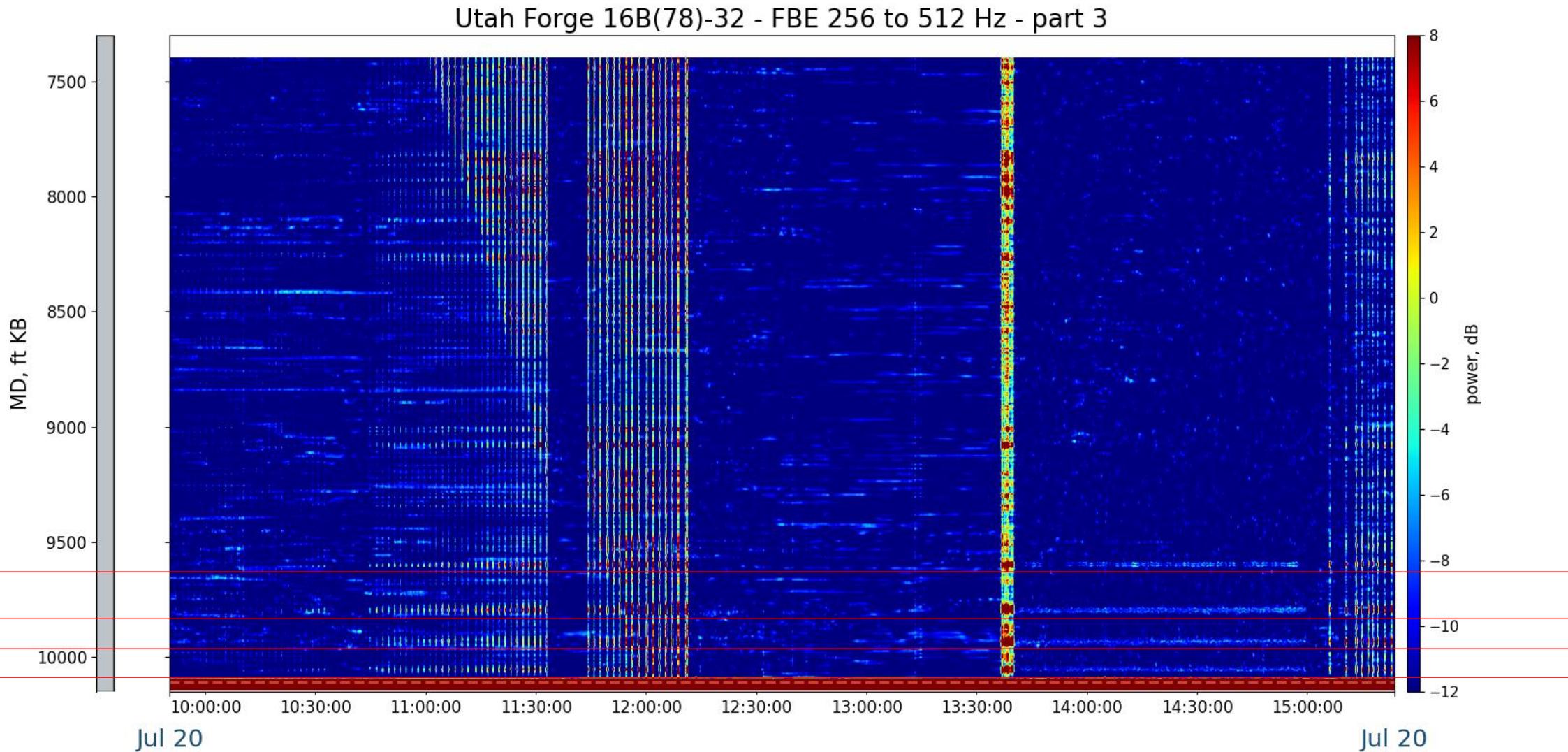
FBE 16 to 64 Hz (2 Octave band)



FBE 64 - 256 Hz (2 Octave band)



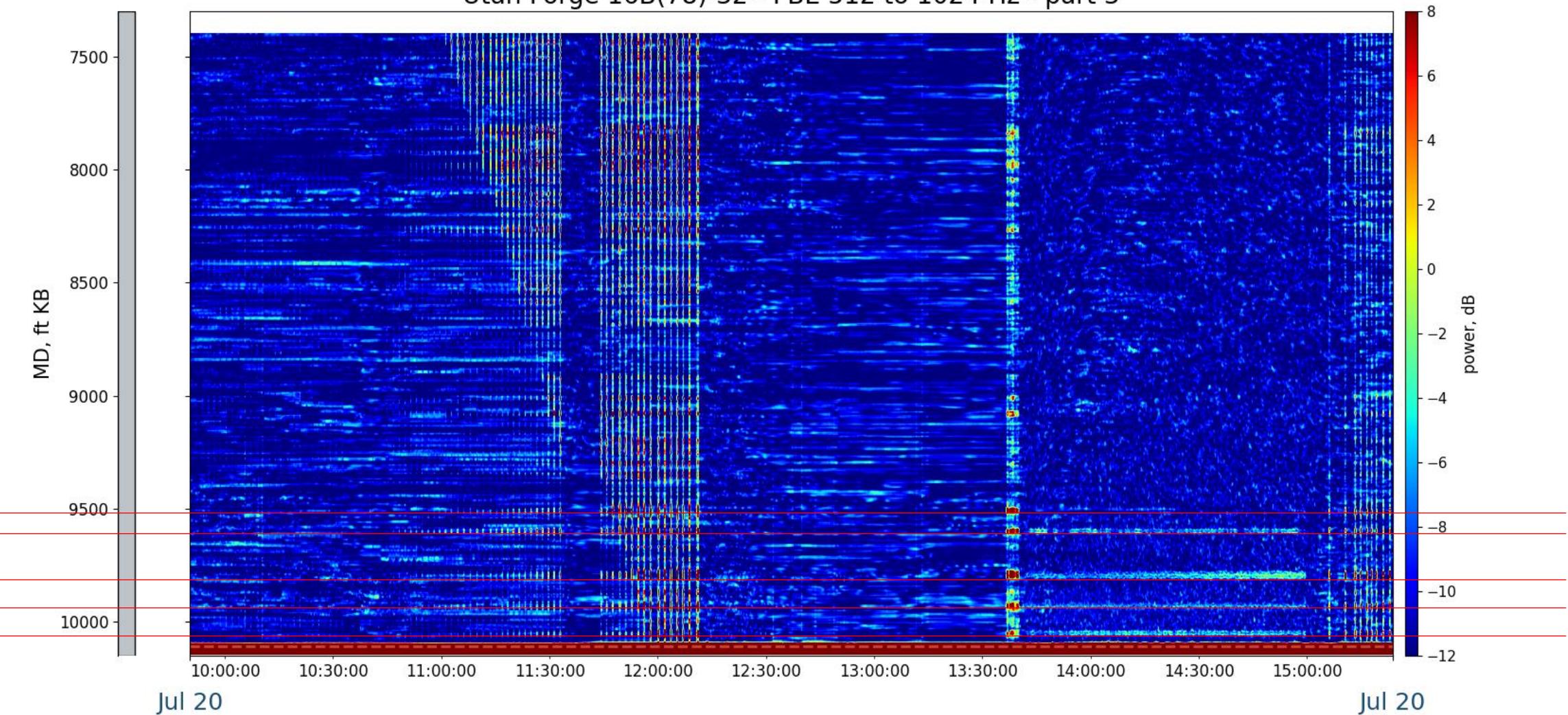
FBE 256 – 512 Hz (1 Octave band)



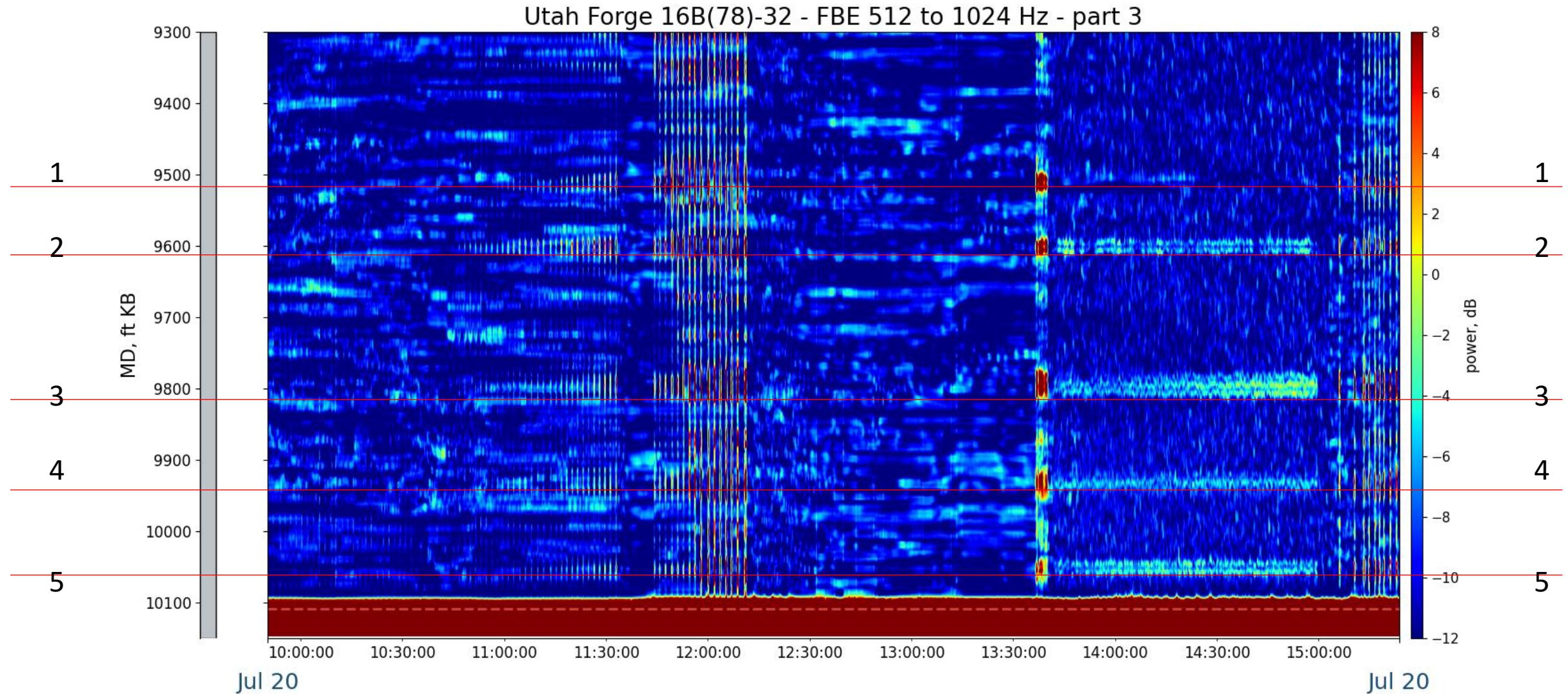
FBE 512 – 1024 Hz (1 Octave band) Best Band to See Features



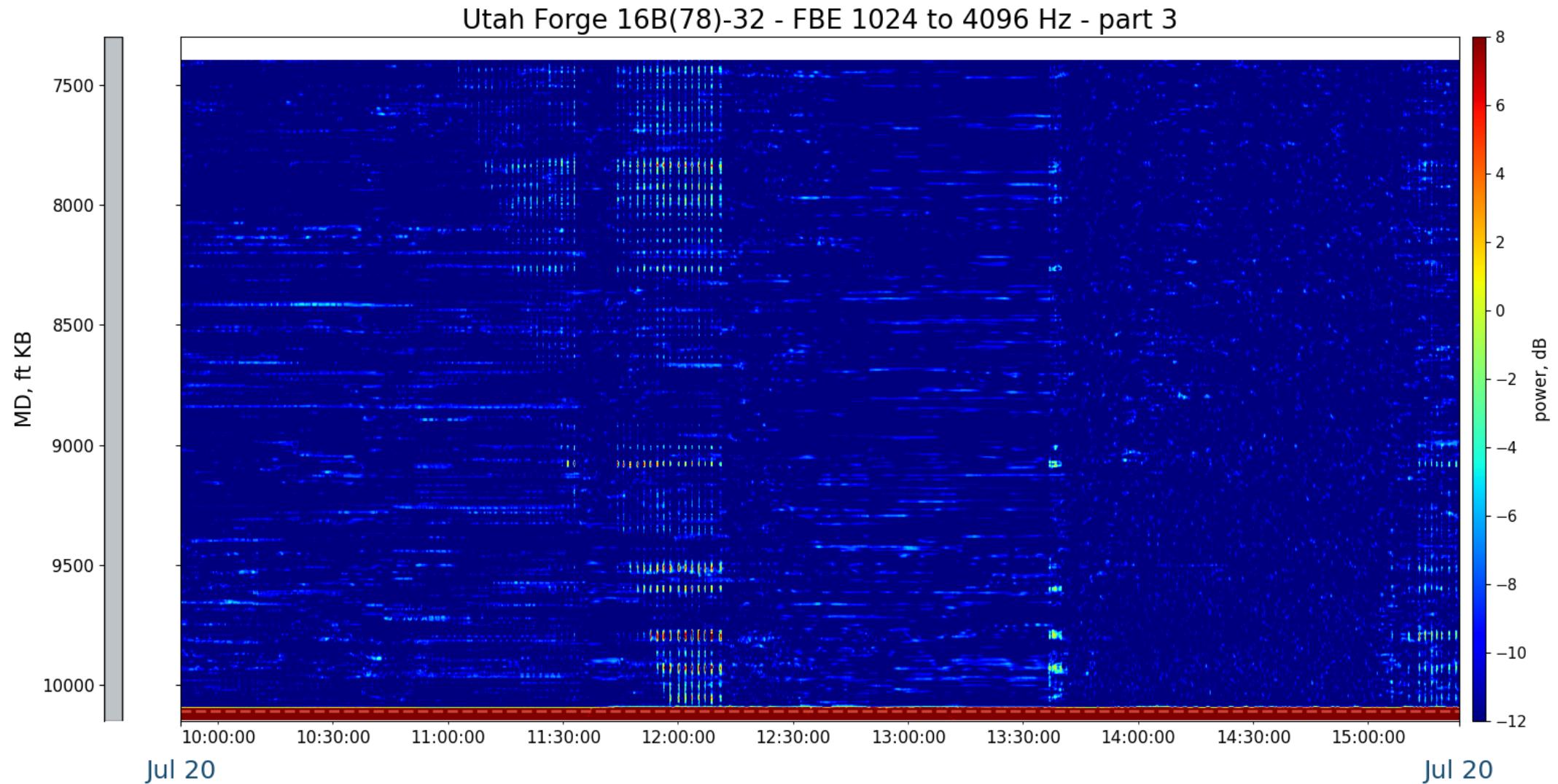
Utah Forge 16B(78)-32 - FBE 512 to 1024 Hz - part 3



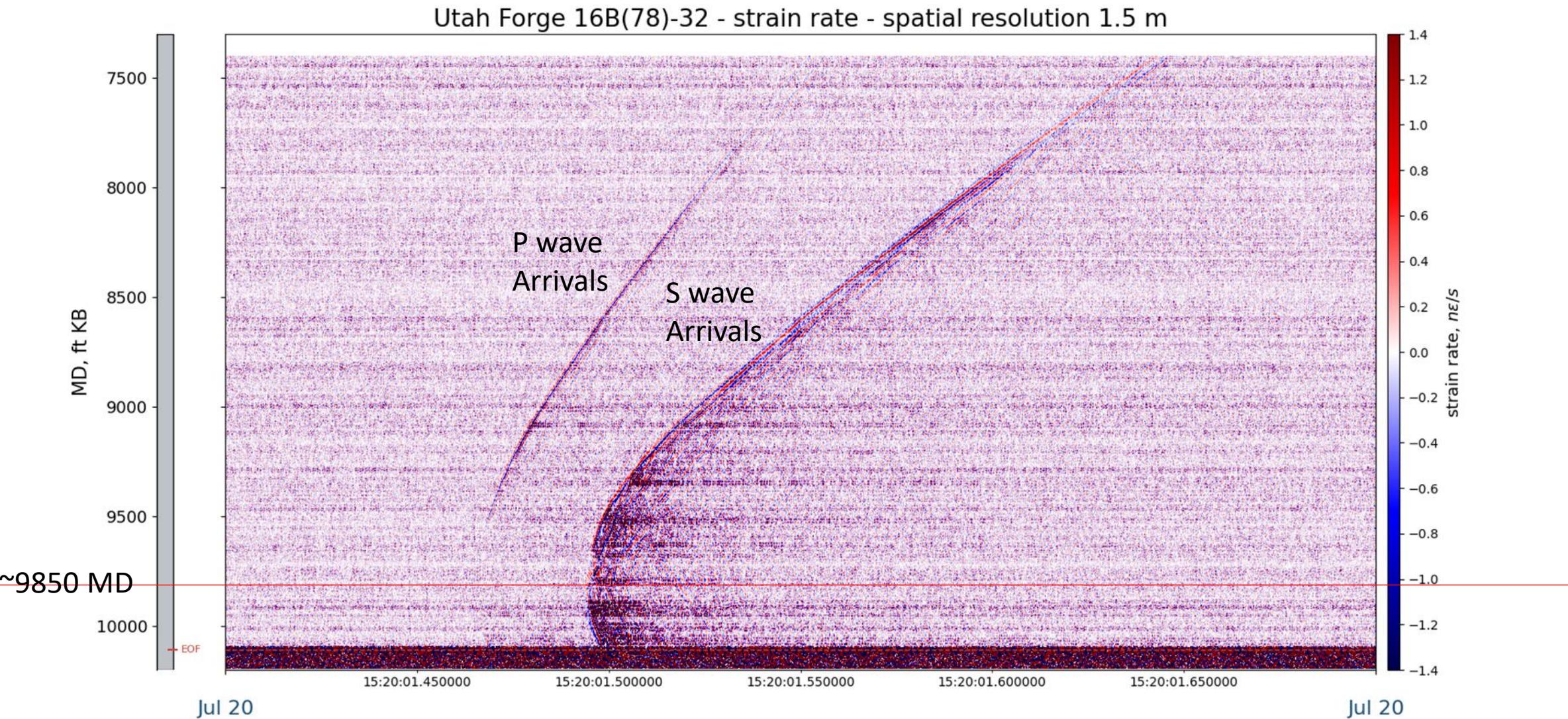
FBE 512 – 1024 Hz (zoomed in) to features of interest



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



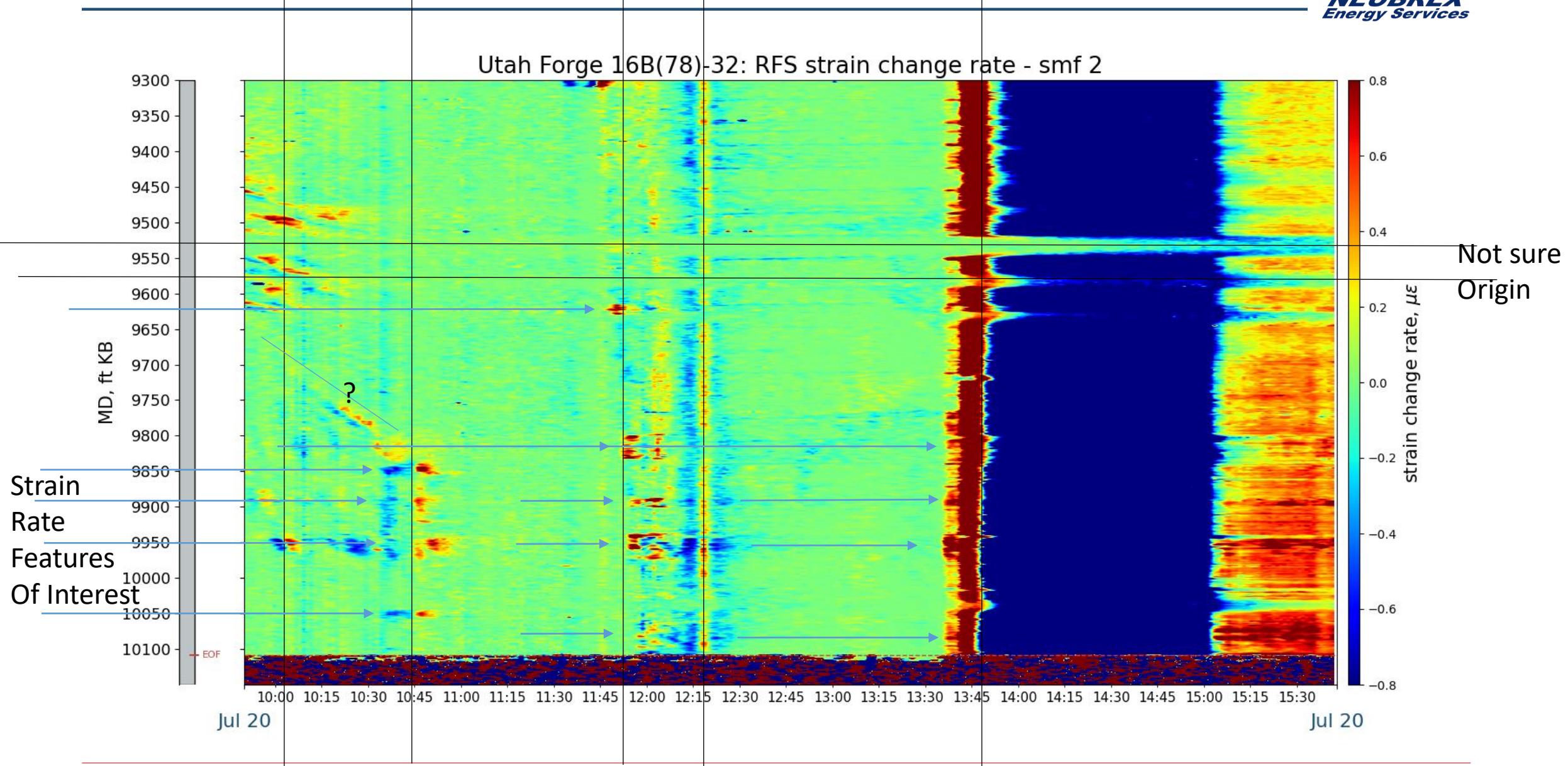
MS Event extracted from the Full Band DAS –Note Apex Depth



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



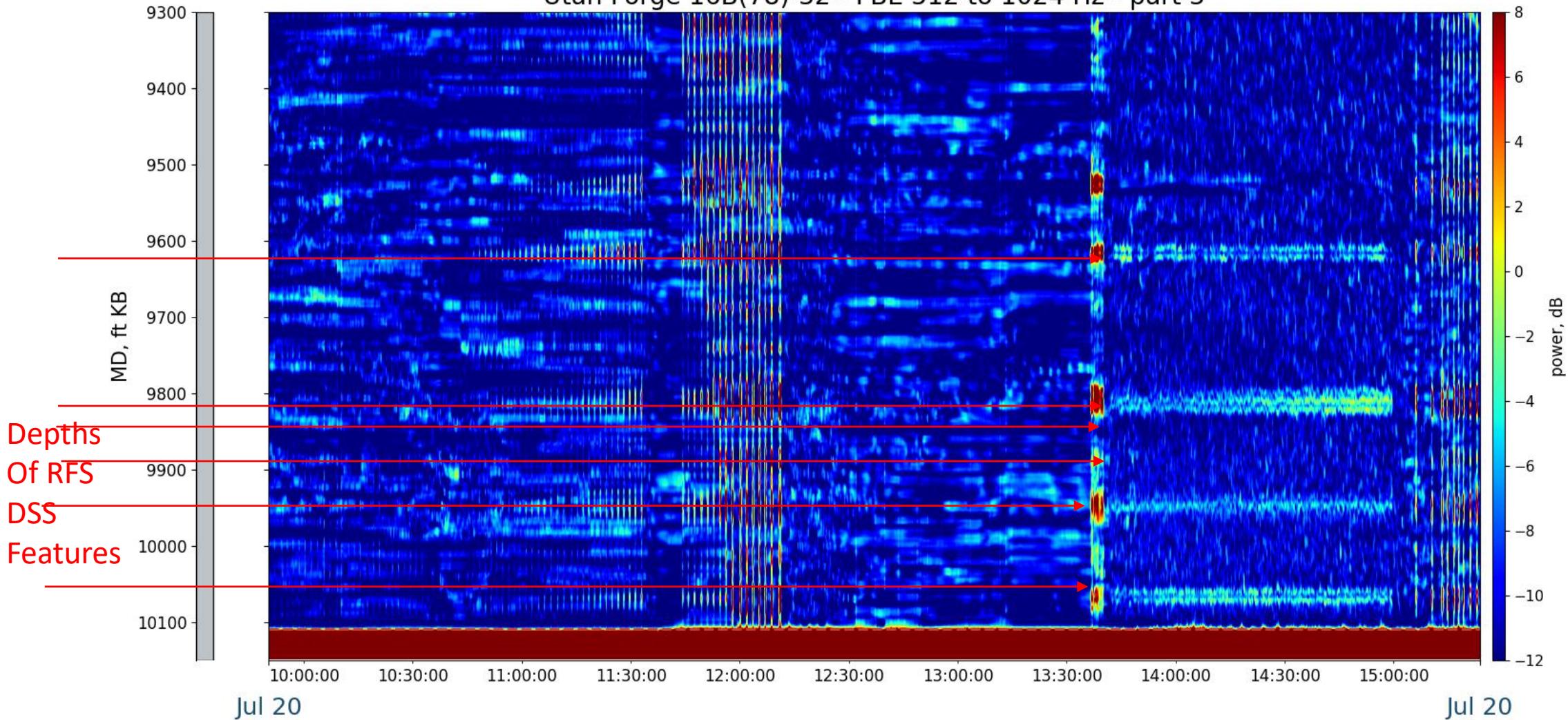
Utah Forge 16B(78)-32: RFS strain change rate - smf 2



DAS 512 – 1024 Hz With Arrows Indicating RFS DSS Features



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



Overlay of LFDAS with RFS DSS (quasi-static) strain rate

