



Exceptional service in the national interest

# INITIAL FINDINGS FROM THE SANDIA 1600 FEES CHANNEL

Hunting for signals, finding more questions

**Thom R. Edwards, Samuel S. Jackson**  
(Sandia National Labs)

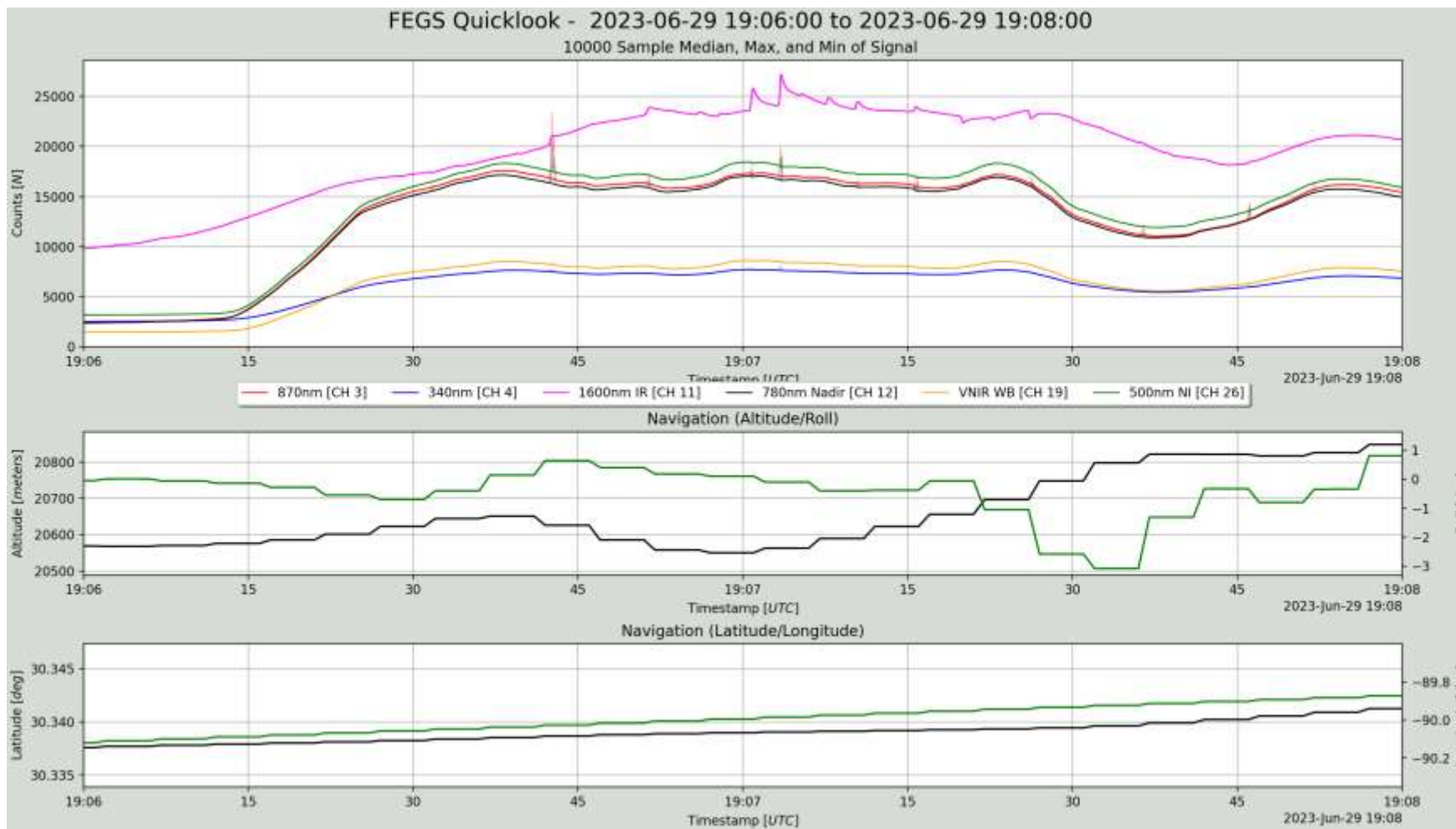
GLM Science Meeting 2023

# SANDIA 1600NM CHANNEL

- Timeline:
  - November 2022: Initial collaboration discussions with NASA team.
  - January 2023: Sandia effort began in earnest to provide 1600nm channel using modified FEES design.
  - April 2023: Delivered radiometer to MSFC for hardware integration and initial testing in Huntsville, AL.
  - June 2023: Participated in upload to ER-2 high altitude aircraft at Edwards AFB, Palmdale, CA.
  - July 2023 : Supported science flights and data analysis at MacDill AFB in Tampa, FL.
- Initial results interesting and unexpected, investigation ongoing:
  - Unexpected responses during day flights, including negative transients associated with lightning flashes.
  - Limited response during night but consistent with other channels when it does occur.
  - Multiple troubleshooting investigations done in the field, with major hardware related issues ruled out.



# TRANSIT FLIGHT



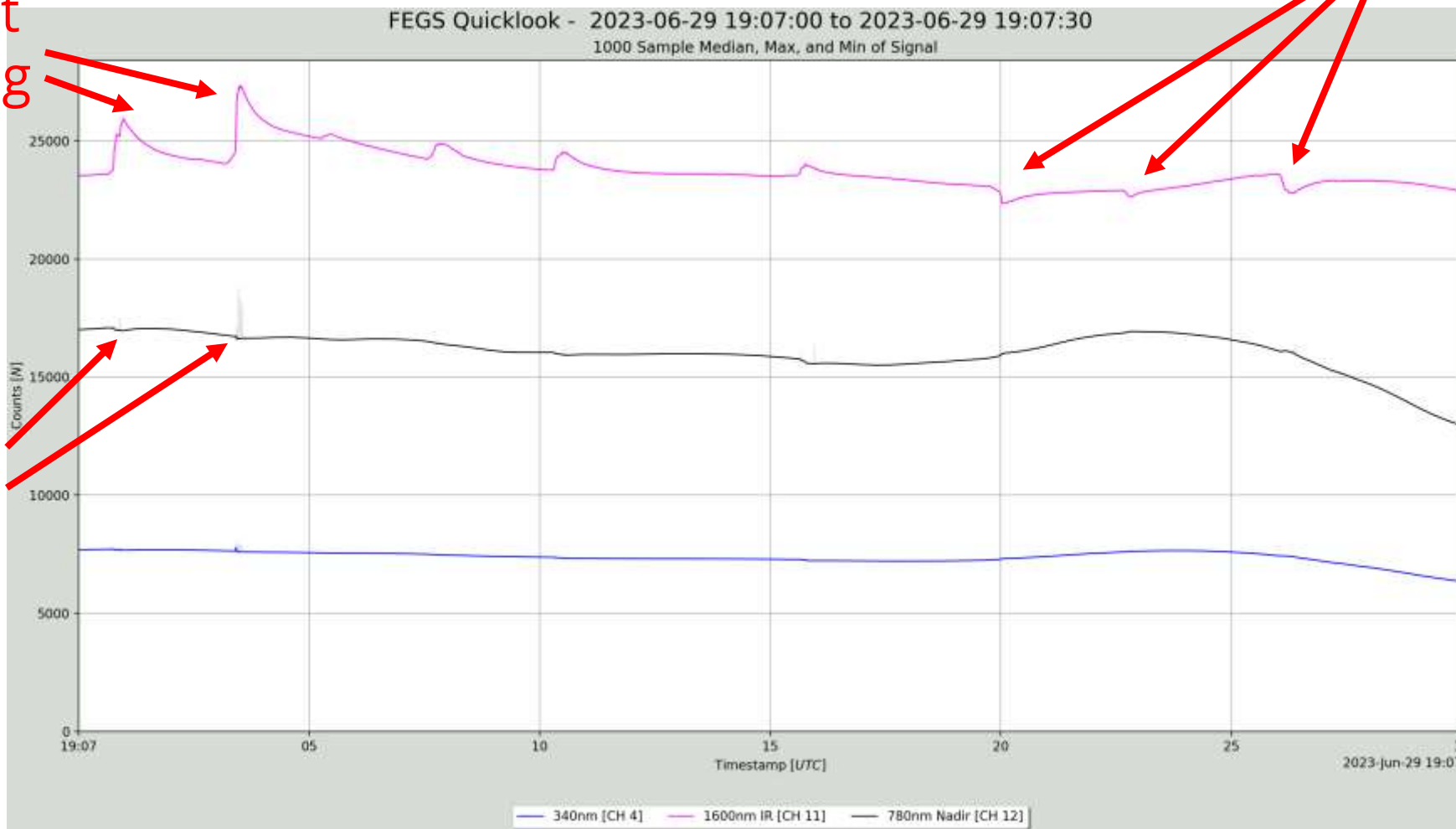


# TRANSIT FLIGHT (ZOOM IN)

Somewhat Concerning

Highly Concerning

Likely Lightning



# HUNTING FOR SIGNALS

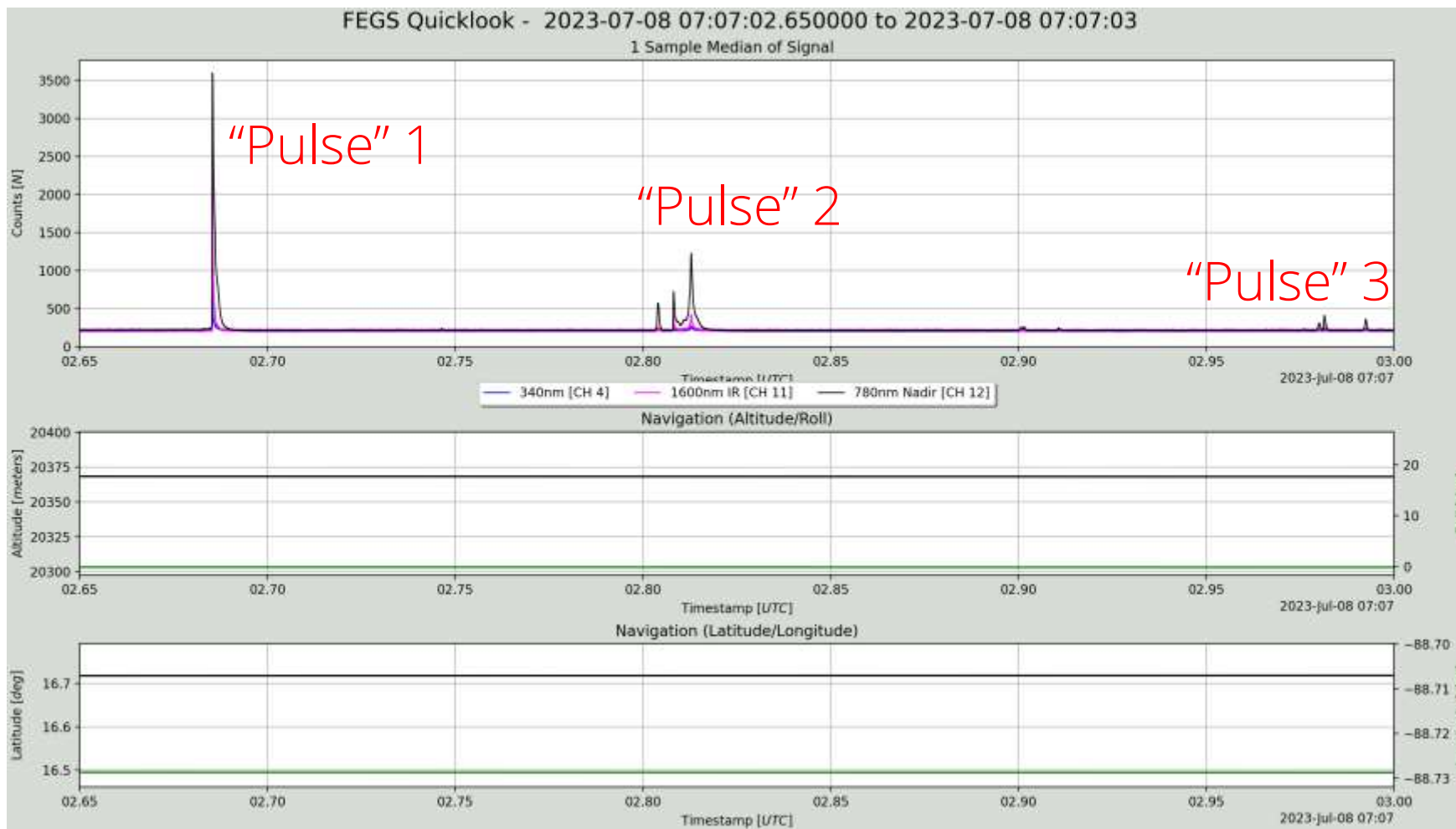
- Initial results from daytime flights were highly concerning
  - Negative transients?
  - NASA team performed multiple tests at MacDill to troubleshoot (see picture to right), no obvious issues found
- During campaign, **one** pulse found in 1600nm channel that looked potentially real,... so let's go hunting!
- Selection Criteria:
  - Must be during a "flat and level" period (i.e. Roll close to 0)
  - Must be at altitude (i.e. above ~60000 feet)
  - Must have an associated 780nm nadir and 340nm response
- In practice, very difficult to find realistic signals in 1600nm channel during day flights, so sticking to night flights
- Other notes:
  - Signals shown here are in counts, so relative intensity should be taken very lightly
  - **Results highly preliminary, discovery and analysis ongoing**



Signal generator and aluminum plate used in the field to debug potential hardware problems on the optical payload.

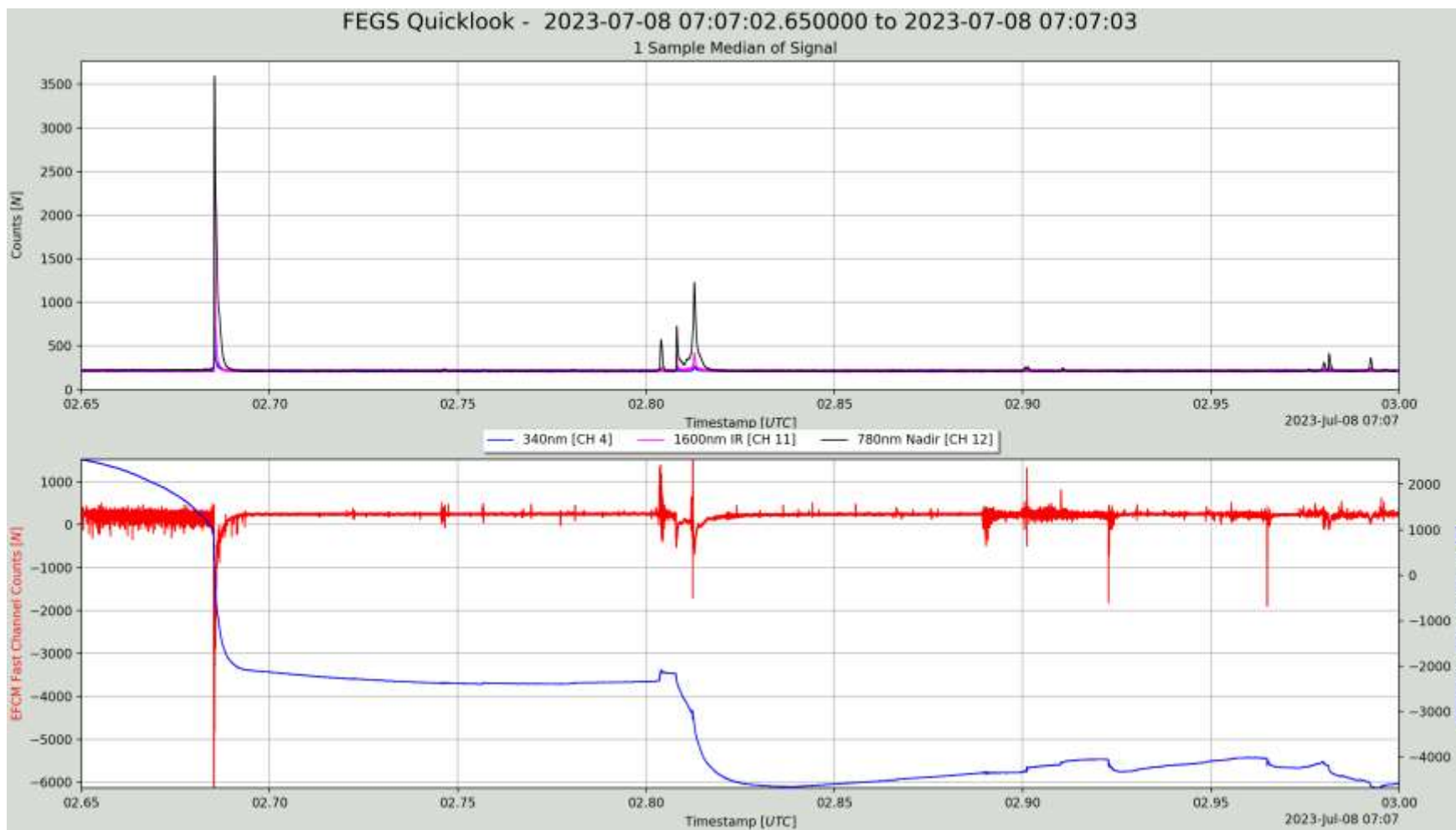


# A STRONG CONTENDER



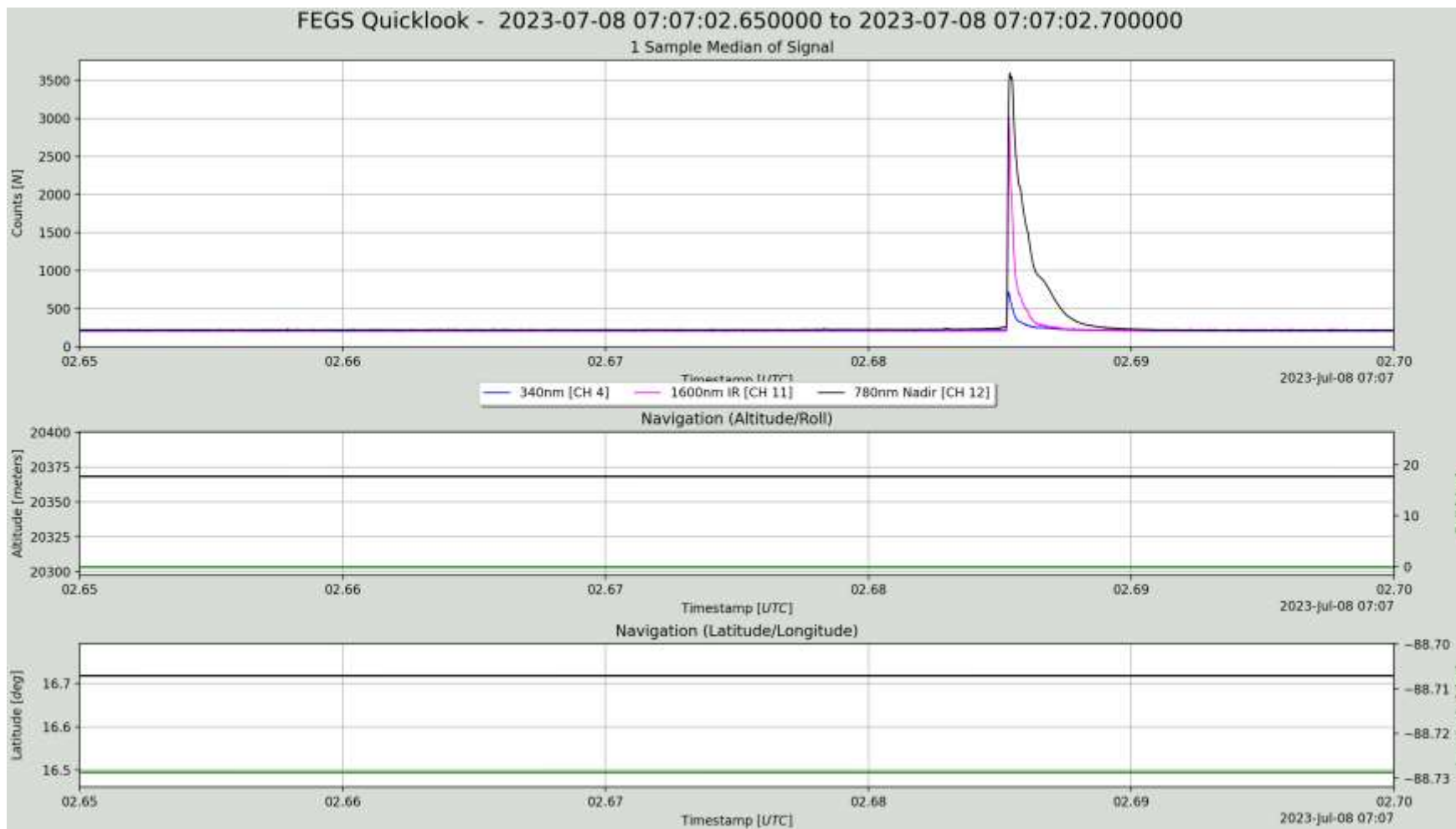


# ASSOCIATED ELECTRIC FIELD CHANGES





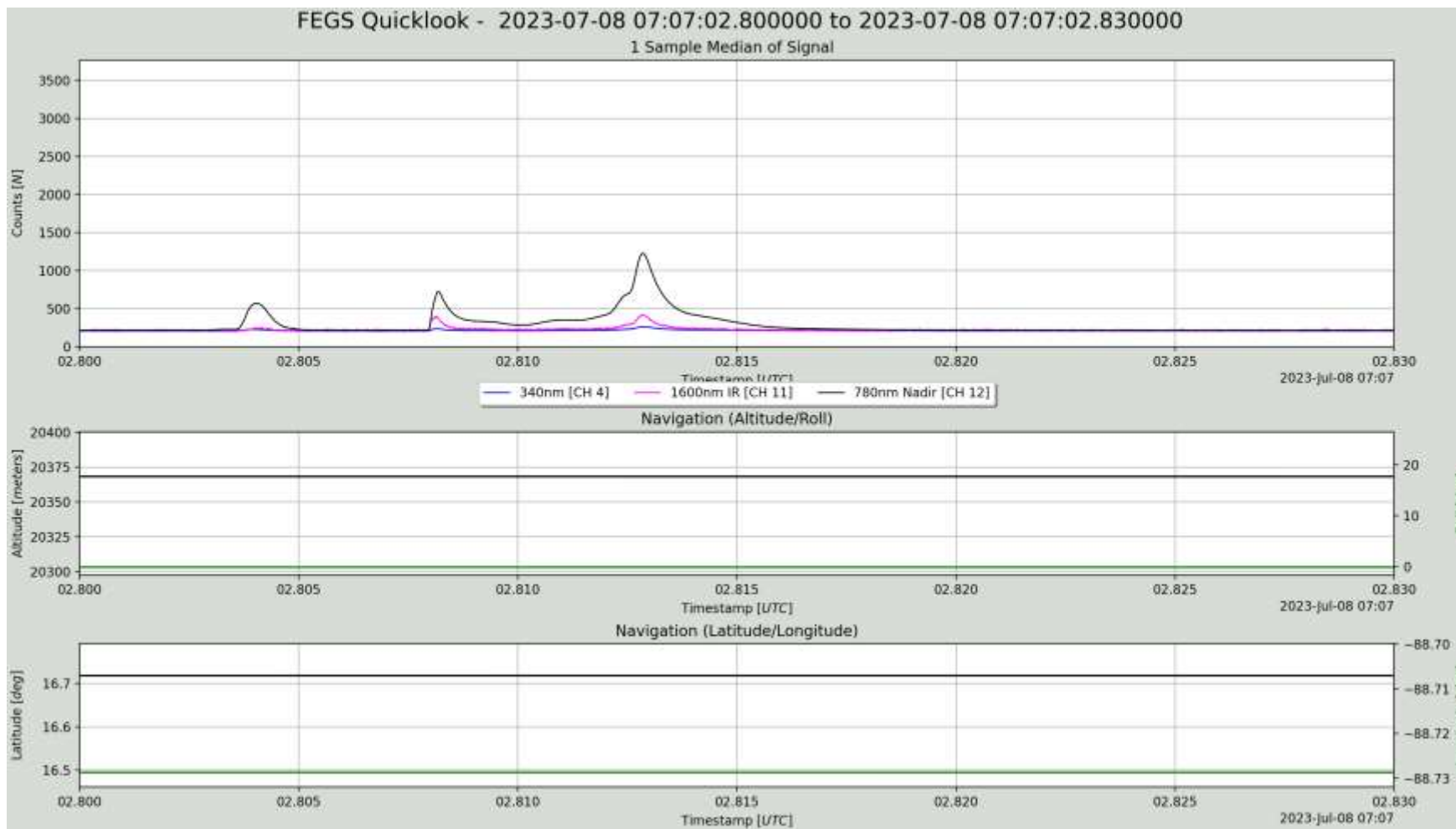
# PULSE 1





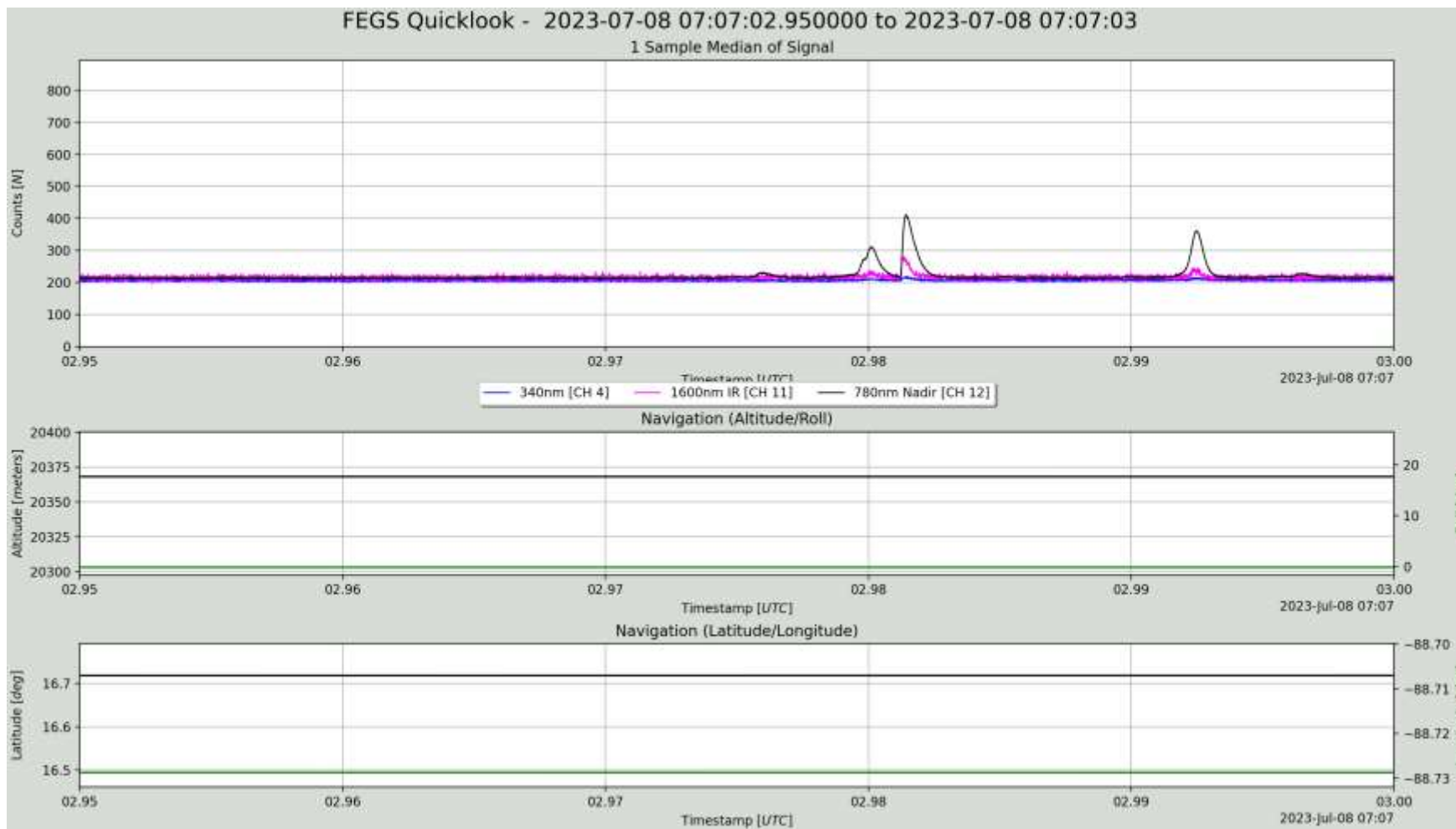


# PULSE 2





# PULSE 3



## (PRELIMINARY) CONCLUSIONS

- From the first two night flights (the 6<sup>th</sup> and the 8<sup>th</sup>), found ~10 signals in the 1600nm channel that meet the selection criteria.
- ~10 more signals found during first two night flights, but happen during turns.
- Have found pulses in the 1600nm channel that have associated activity in EFCM data.
- Still lots of 780nm channel responses with no 1600nm activity.
- Takeaways:
  - Integration and troubleshooting didn't find anything obvious to suggest the channel wasn't going to work.
  - Have found some signals that look plausibly lightning related.
  - ... still looking for more, and looking for some physical explanations before making any major statements.
  - Still lots of room for hardware related causes.

# BACKUPS/EXTRAS

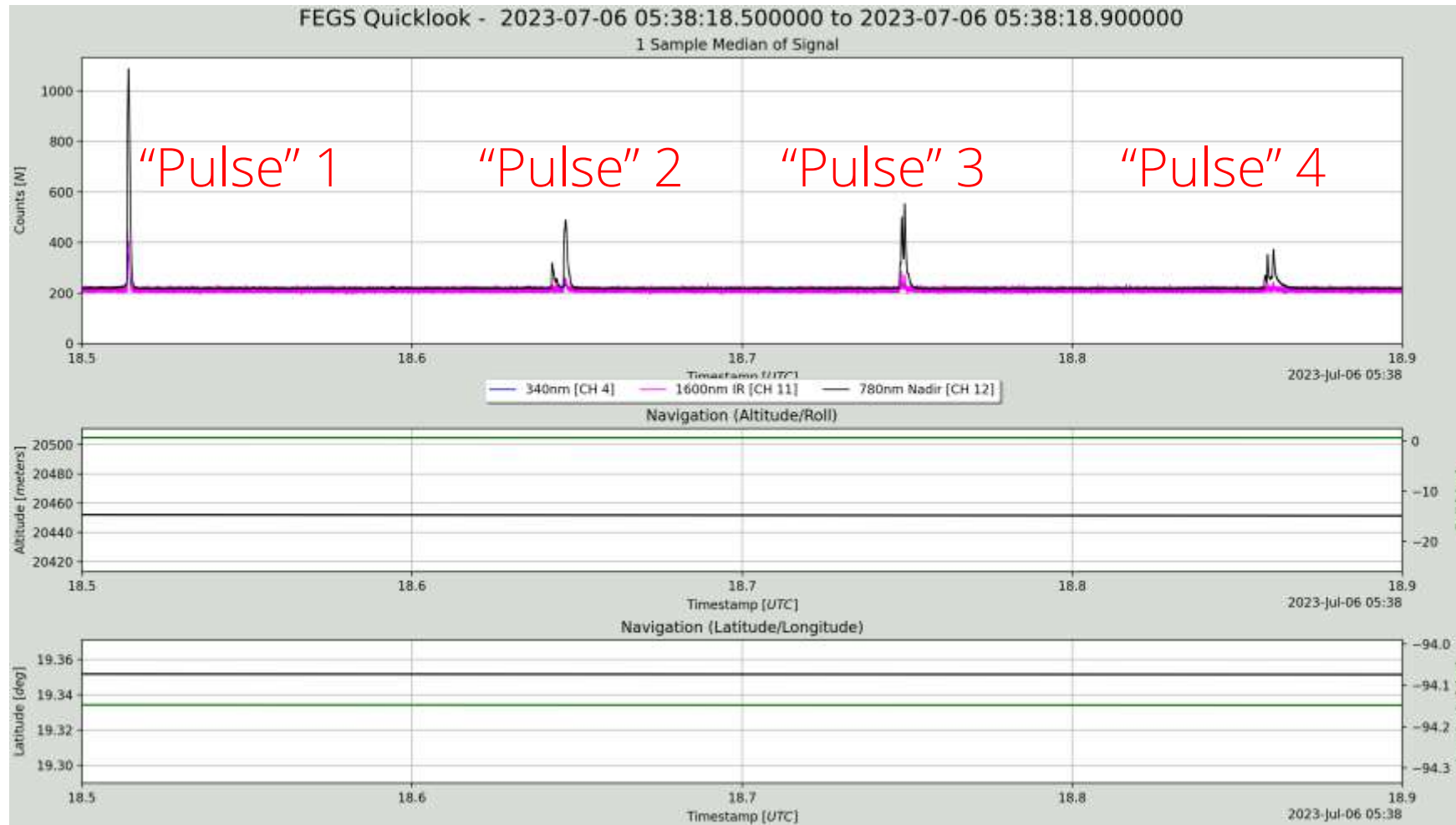


# SECOND CLUSTER



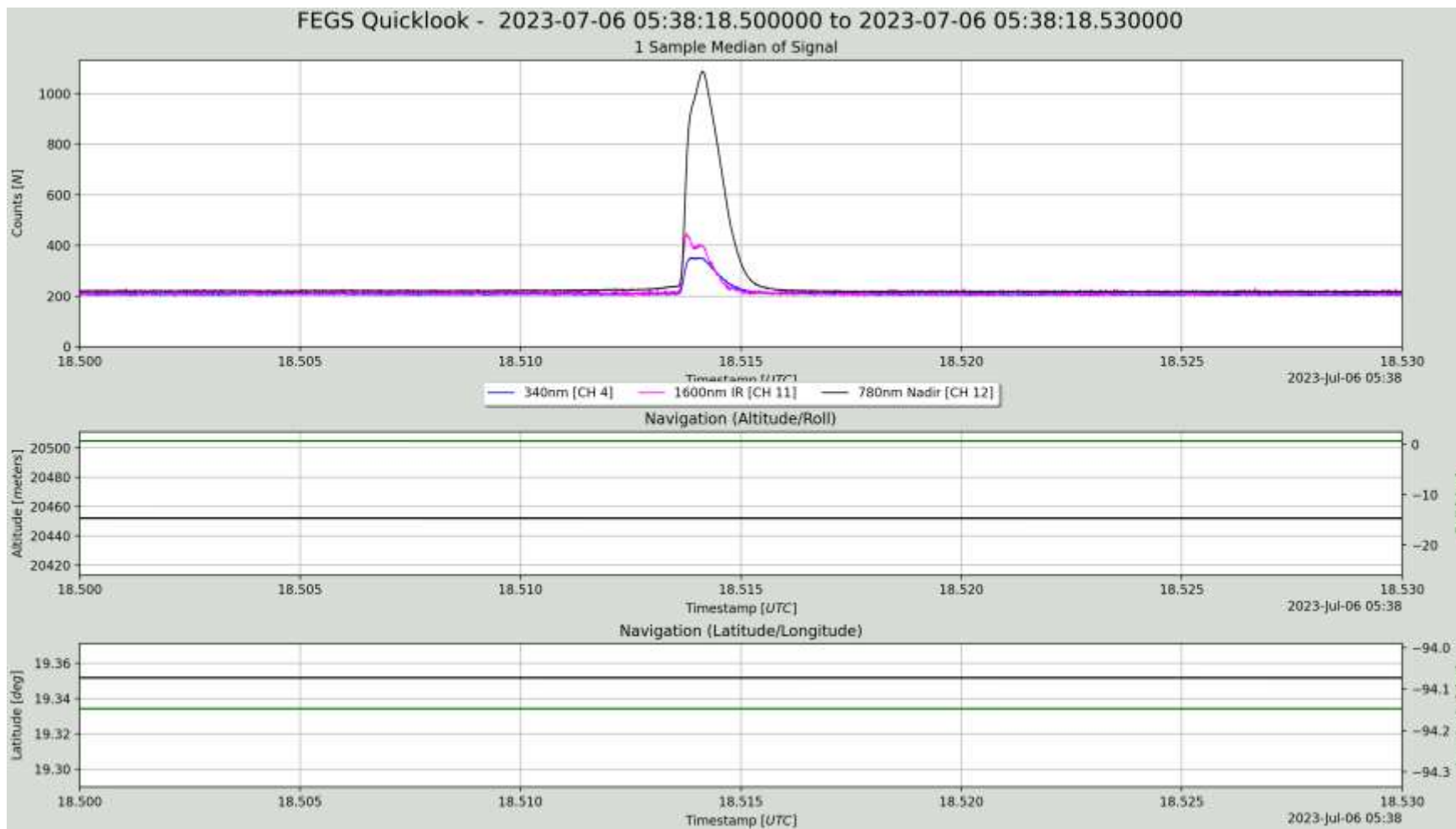


# ANOTHER CLUSTER OF ACTIVITY (FIRST NIGHT FLIGHT)



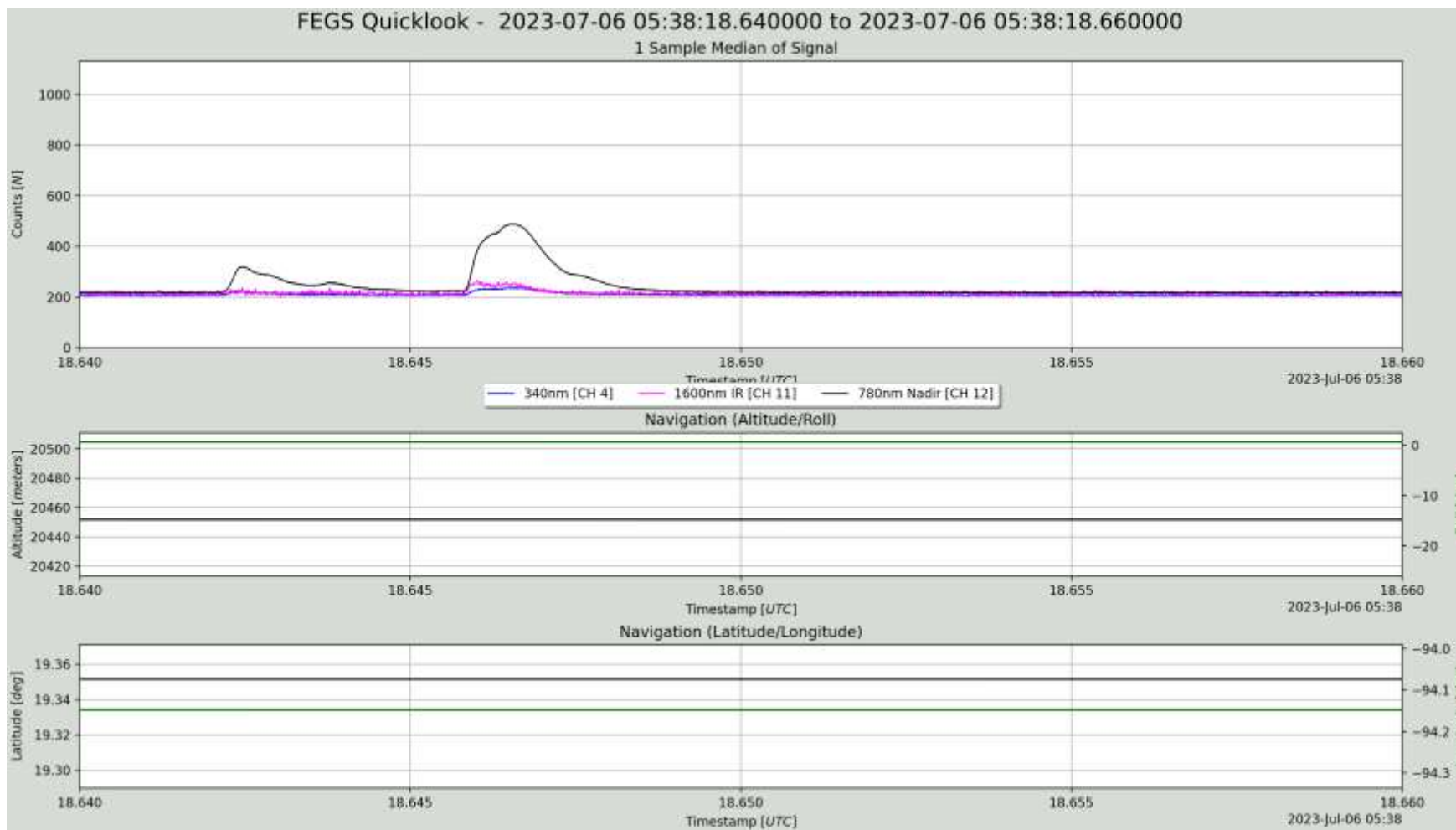


# PULSE 1





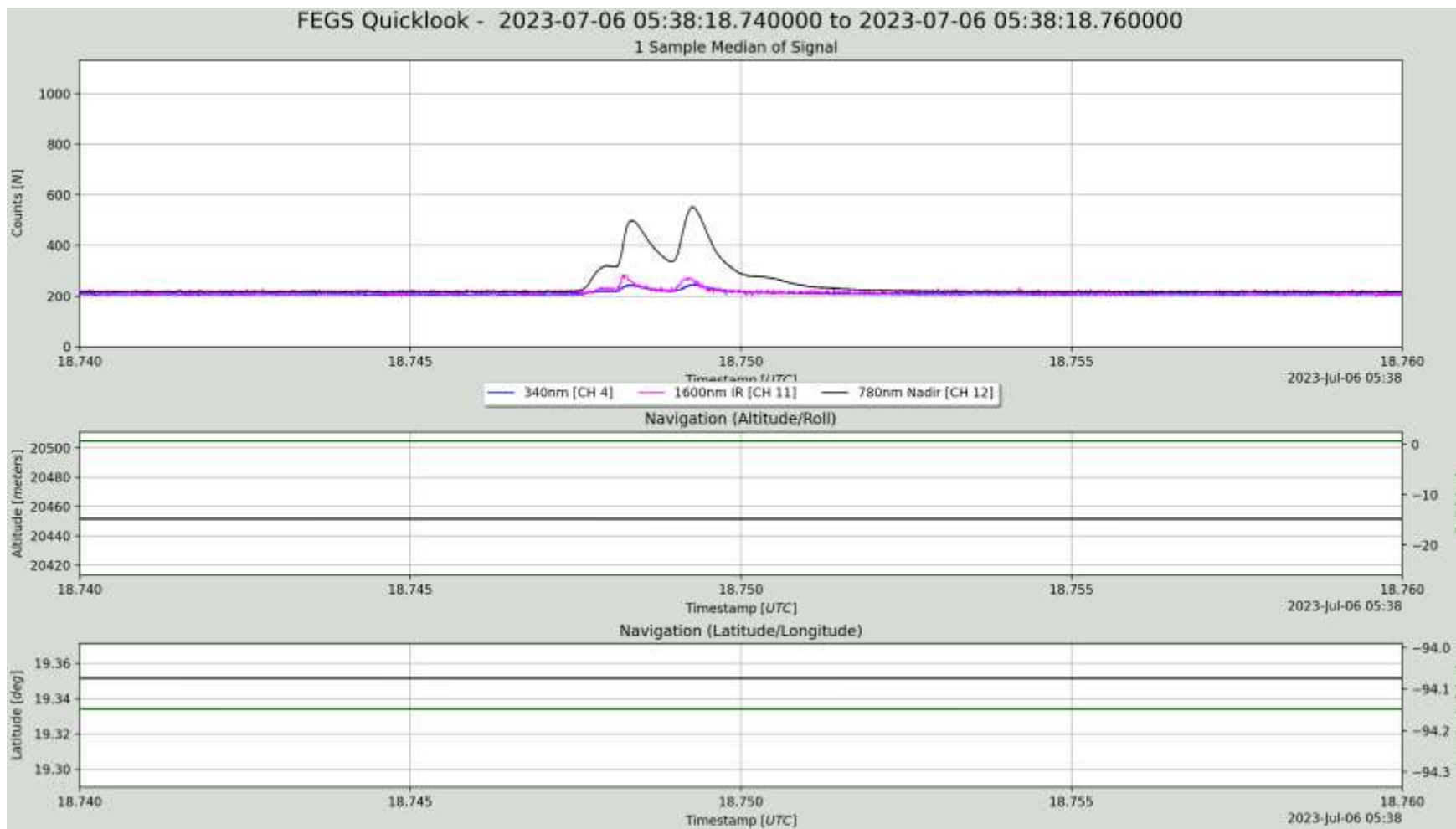
# PULSE 2





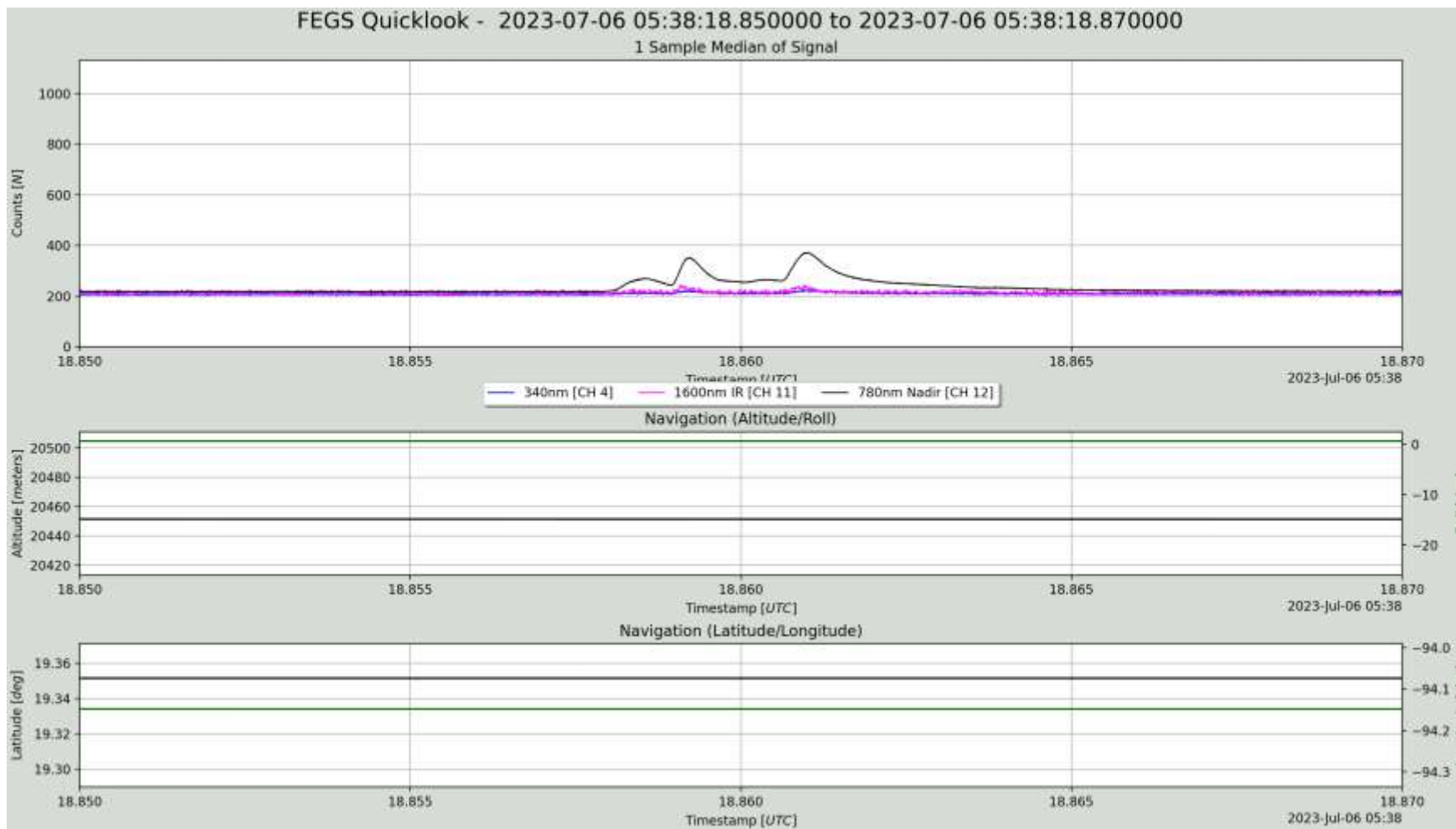


# PULSE 3





# PULSE 4

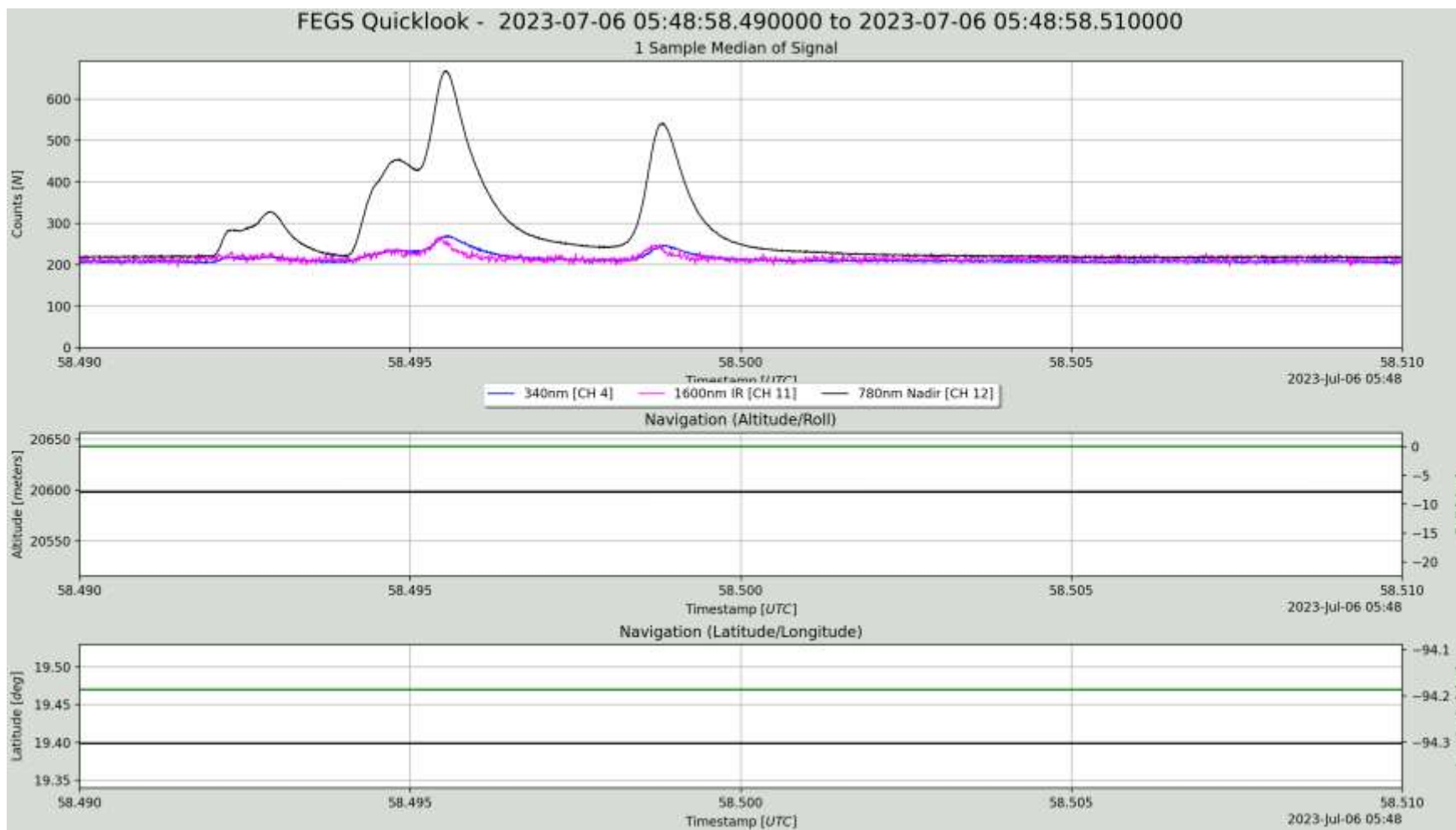


# EXTRA FINDS



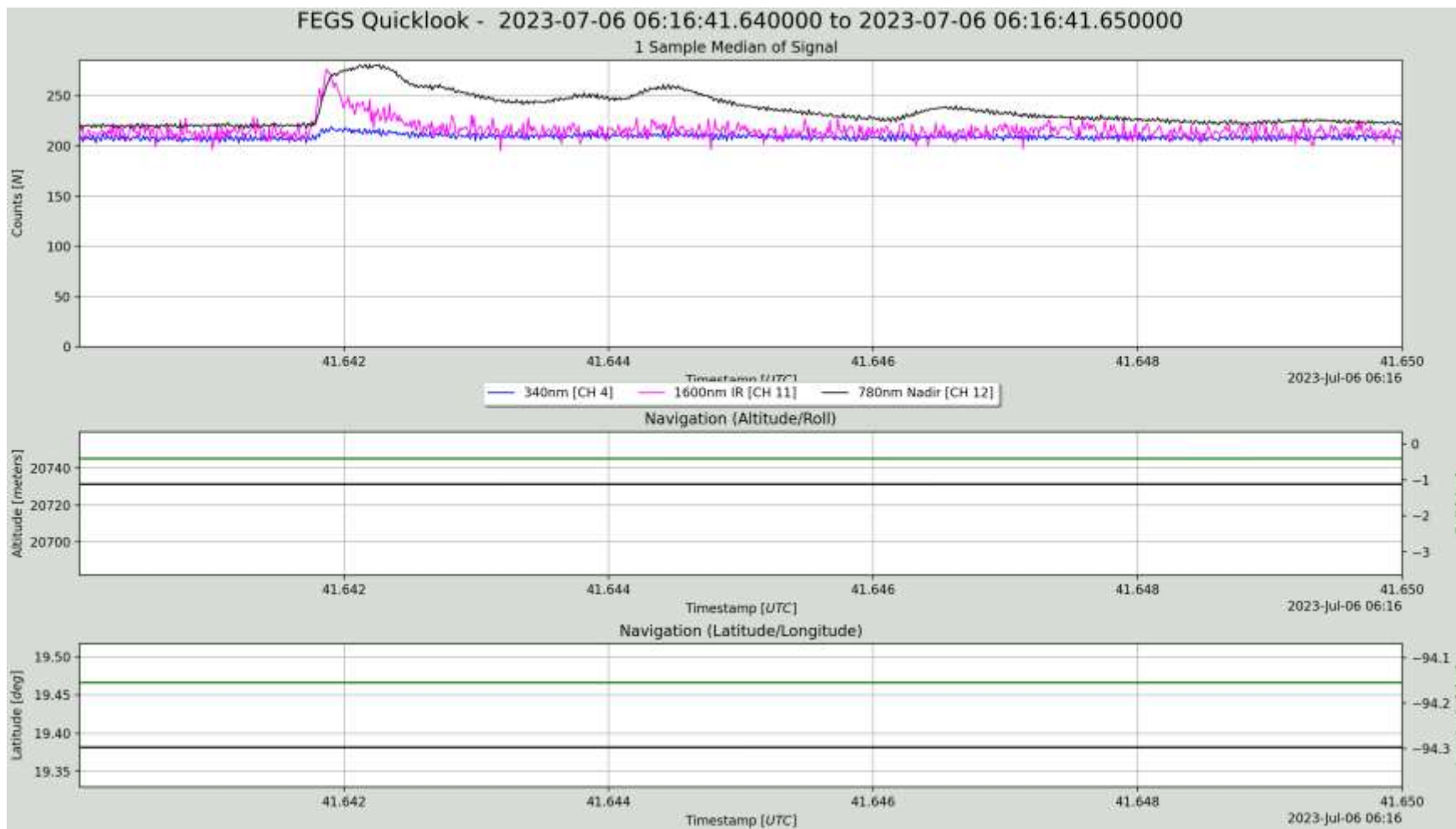


# EXTRA FIND 1



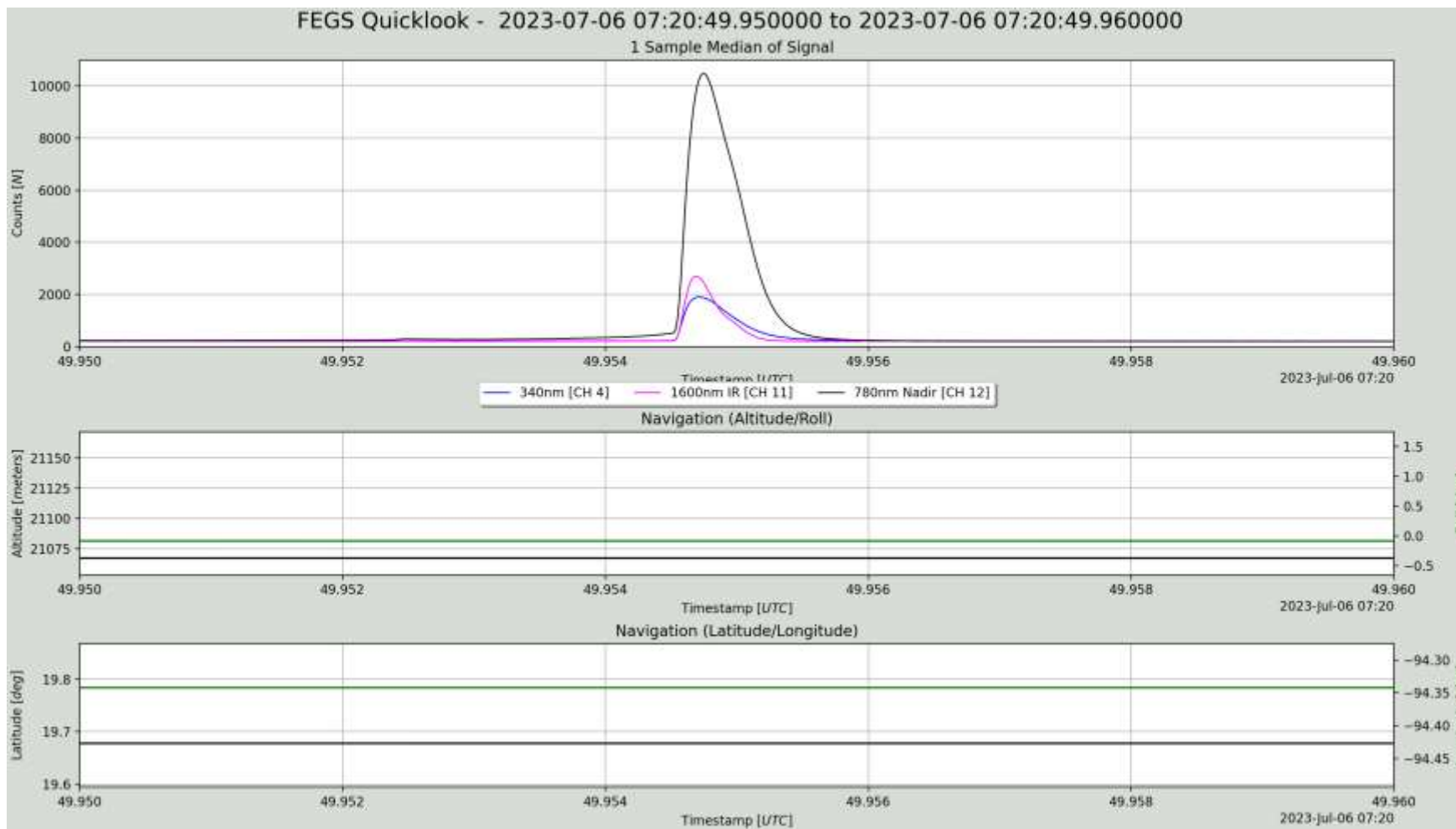


# EXTRA FIND 2





# EXTRA FIND 3





# EXTRA FIND 4

