

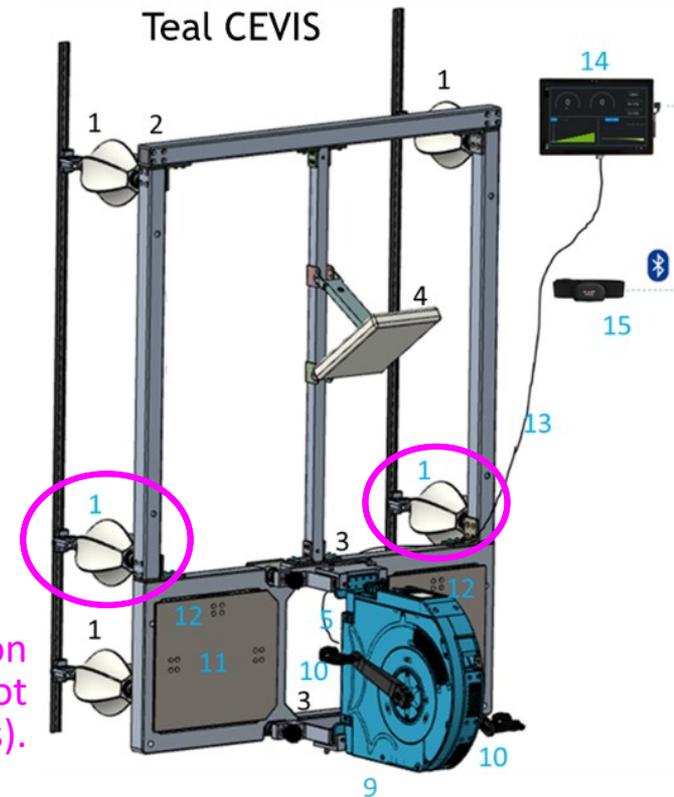
Space Acceleration Measurement System (SAMS) Analysis of Several Teal Cycle Ergometer with Vibration Isolation System (CEVIS) Exercise Sessions, January of 2025, Days 2, 4, 5, and 6



Introduction

1. Analysis of SAMS measurements during 8 Teal CEVIS exercise sessions in January 2025, now where wire rope vibrate isolators are featuring "festive" socks within.
2. Analyze SAMS data from two sensor heads: one at LAB1P4, and one at COL1A3.
3. Primary focus should be on bellwether SAMS sensor head mounted on COL1A3, S/N 121f08.

NOTE: These 2 vibration isolation mechanical components were not seen in video clip (just 4 corners).



Outline

- Topology: SAMS sensors and Teal CEVIS
- Video Clip Summary, GMT 2025-01-02
- Eight CEVIS Exercise Sessions
- SAMS Data Analysis Overview
- Conclusion

Topology

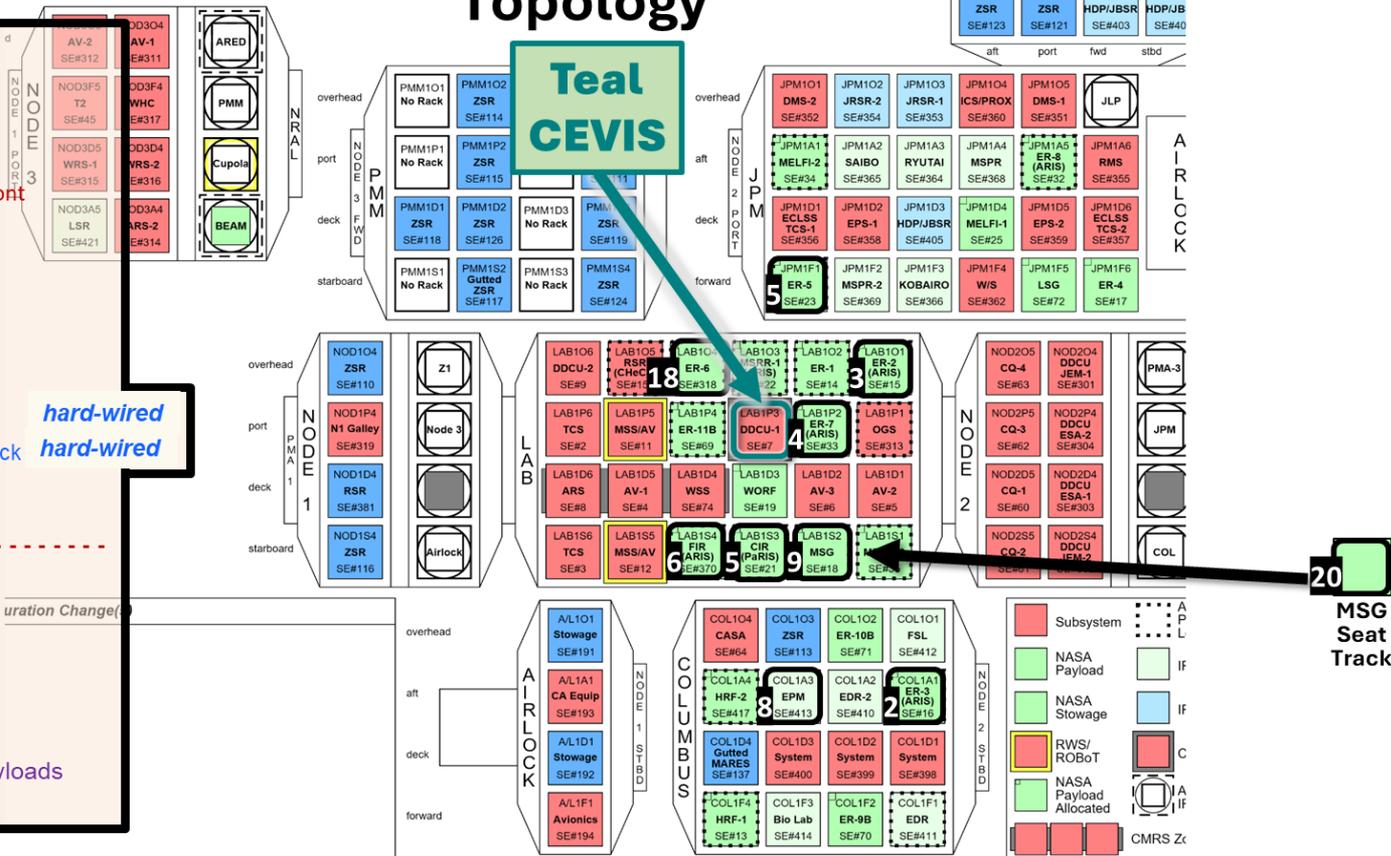
SAMS Sensor Head Locations

- 2** SE F02, COL1A1, ER3, Seat Track
 - 3** SE F03, LAB101, ER2, Lower Z Panel
 - 4** SE F04, LAB1P2, ER7, Cold Atom Lab Front
 - 5** SE F05, JPM1F1, ER5, Inside RTS/D2
 - 8** SE F08, COL1A3, EPM, near PK-4
 - 9** TSH-ES09, LAB1S2, MSG
 - 5** TSH-ES05, LAB1S3, CIR
 - 6** TSH-ES06, LAB1S4, FIR
 - 18** TSH-ES18, LAB104, ER-6
 - 20** TSH-ES20, LAB1S2, MSG, Seat Track
- TSH-ES03, -ES19, stowed spares

hard-wired
hard-wired

LEGEND:

- Sensor that does not move
- Sensor that has moved or may move
- Sensor that has never moved
- Stowed or not currently connected
- MSG sensor gets installed for some payloads



SAMS Sensor Heads Used in Analysis:

- 4** S/N 121f04, LAB1P2, ER-7, Cold Atom Lab Front (near CEVIS)
- 8** S/N 121f08, COL1A3, EPM, near PK-4 [bellwether]

Video Clip Summary, GMT 2025-01-02

Event	Description	Offset (mm:ss)	GMT 2025-01-02 (hh:mm:ss)
Start	Teal CEVIS Video Clip Start	00:00	10:36:00
Event 1	Lower-left push 4 times	01:42	10:37:42
Event 2	Upper-left push 2 times	01:51	10:37:51
Event 3	Upper-right push 3 times	02:01	10:38:01
Event 4	Lower-right push 9 times	02:12	10:38:12
Stop	Teal CEVIS Video Clip Stop	03:36	10:39:36

We looked qualitatively via spectrogram at a 4-hour span, below 6 Hz for SAMS measurements centered on video clip and including both SAMS sensor heads. ***See next 3 pages.***

Video Clip Summary, GMT 2025-01-02

Flipping quickly, back-and-forth between **next 2 slides** in order to compare SAMS measurements in US LAB near CEVIS (121f04 on LAB1P2) to bellwether sensor head in the Columbus module (121f08 on COL1A3), we note:

- **Three distinct periods:**
 1. Period #1 most likely an exercise period before the video clip.
 2. Period #2 a non-CEVIS exercise period that overlaps the video clip.
 3. Period #3 a loud (likely BD-2) exercise period after the video clip
- Each of the 3 periods noted above produced responses (vibratory accelerations) that were, as expected for exercise, **more pronounced in the Columbus module.**
- Despite the video clip showing several instances of crew hand locally pushing on 4 corner vibe isolators of CEVIS, **we only see one impulsive acceleration indicated by the white arrow on the next page and that came after the video clip ended.** The video clip span is indicated on the next page by the 2 magenta, horizontal (time) axis tick marks and labels.

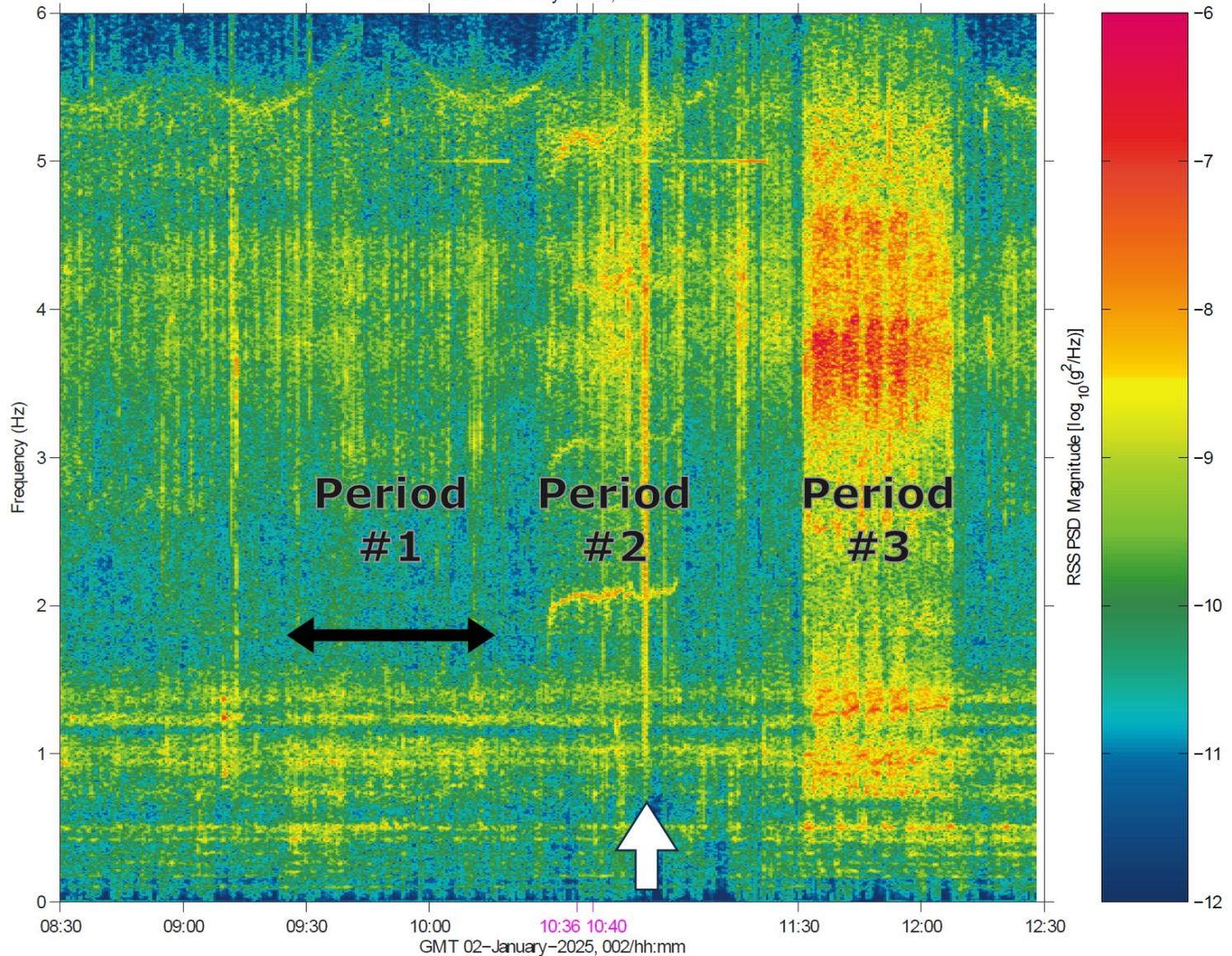
SAMS Sensor 121f04 Located at LAB1P2 (nearest CEVIS)

sams2, 121f04006 at LAB1P2, ER7, Cold Atom Lab Front Panel:[156.60 -46.08 207.32]
142.0000 sa/sec (6.00 Hz)
 $\Delta f = 0.009$ Hz, Nfft = 16384
Temp. Res. = 30.873 sec, No = 12000

SAMS2, 121f04006, LAB1P2, ER7, Cold Atom Lab Front Panel, 6.0 Hz (142.0 s/sec)

Start GMT 02-January-2025, 002/08:30:00

Sum
Hanning, k = 463
Span = 237.72 minutes



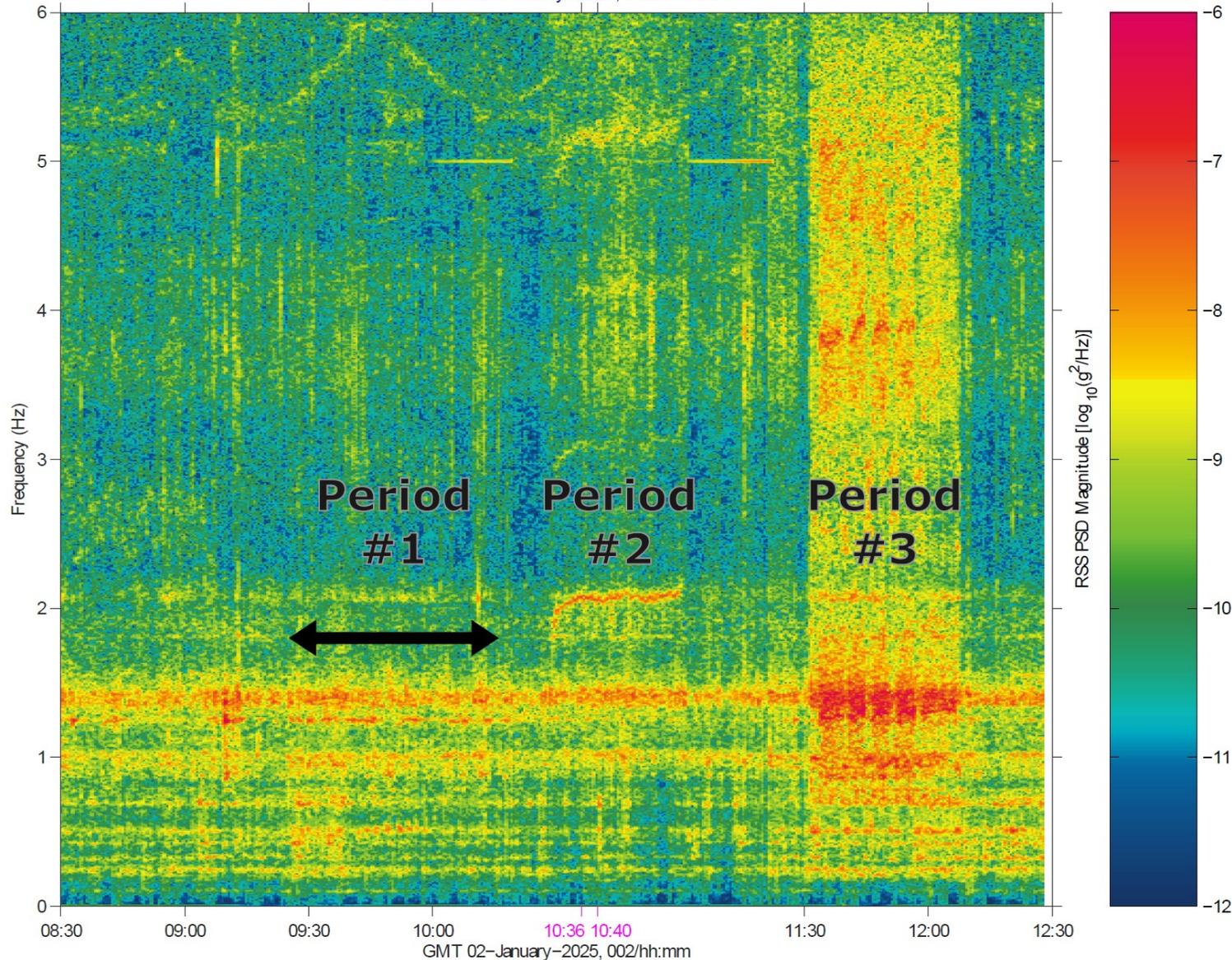
SAMS Sensor 121f08 Located at COL1A3 (bellwether for exercise)

sams2, 121f08006 at COL1A3, EPM, near PK-4:[371.17 287.43 165.75]
142.0000 sa/sec (6.00 Hz)
 $\Delta f = 0.009$ Hz, Nfft = 16384
Temp. Res. = 30.873 sec, No = 12000

SAMS2, 121f08006, COL1A3, EPM, near PK-4, 6.0 Hz (142.0 s/sec)

Start GMT 02-January-2025, 002/08:30:00

Sum
Hanning, k = 463
Span = 237.72 minutes



Eight CEVIS Exercise Sessions, Jan. 2025

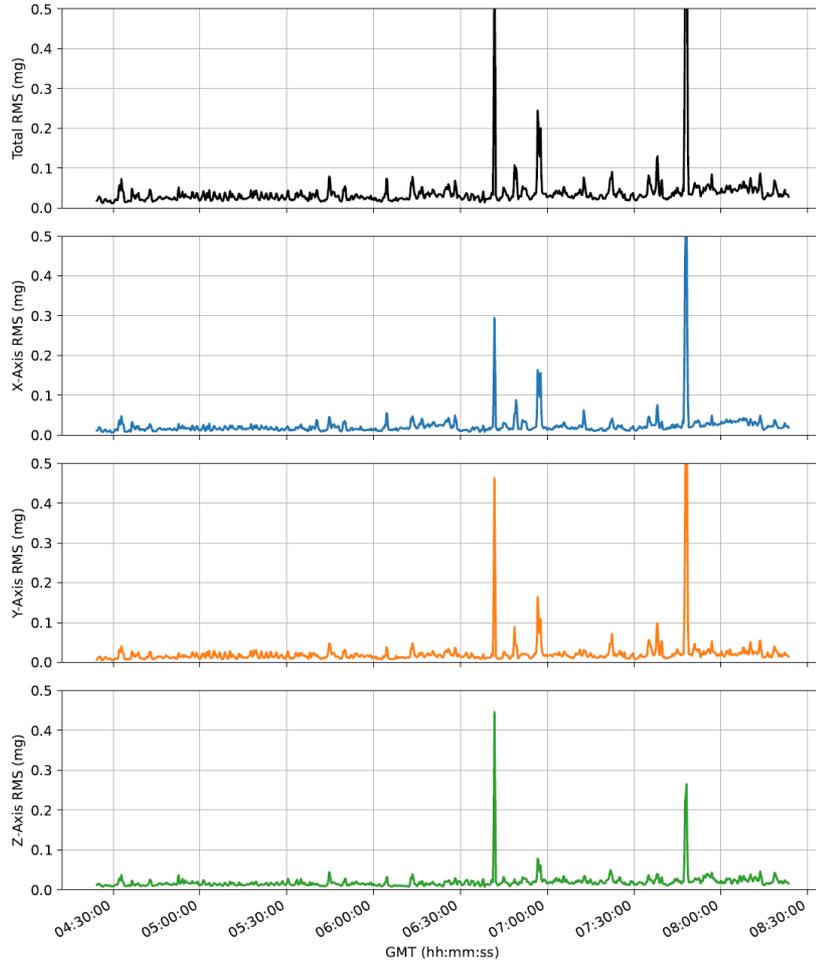
Session #	GMT Start (day/hh:mm:ss)	GMT Stop (day/hh:mm:ss)
1	2025-01-02/06:08:16	2025-01-02/06:39:27
2	2025-01-02/08:31:35	2025-01-02/09:07:53
3	2025-01-02/14:09:56	2025-01-02/14:46:34
4	2025-01-04/06:42:21	2025-01-04/07:17:20
5	2025-01-05/10:46:31	2025-01-05/11:17:37
6	2025-01-05/16:48:24	2025-01-05/16:58:31
7	2025-01-06/05:51:23	2025-01-06/06:27:43
8	2025-01-06/08:34:26	2025-01-06/08:53:20

SAMS Data Analysis Overview

- Generally, concern arises when **exercise (stimulus)** results in **structural excitation (response)** resulting in sustained, resonant vibrations. A bellwether for monitoring exercise in this regard is SAMS sensor head, S/N 121f08, in the Columbus module to gauge structural response regardless of where the stimulus/source is located. For the data considered throughout, though, we looked at another sensor head too, that is, SAMS sensor head, S/N 121f04 located at LAB1P2, close to the Teal CEVIS exercise device (LAB1P3).
- For each exercise session, we quantified via SAMS measurements across a 4-hour span centered on the Teal CEVIS exercise sessions and for both of the 2 SAMS sensor heads mentioned above (one at LAB1P2, and one at COL1A3), we quantified by computing interval root-mean-square (RMS) acceleration plots below 6 Hz. Those are shown on the next 8 pages.

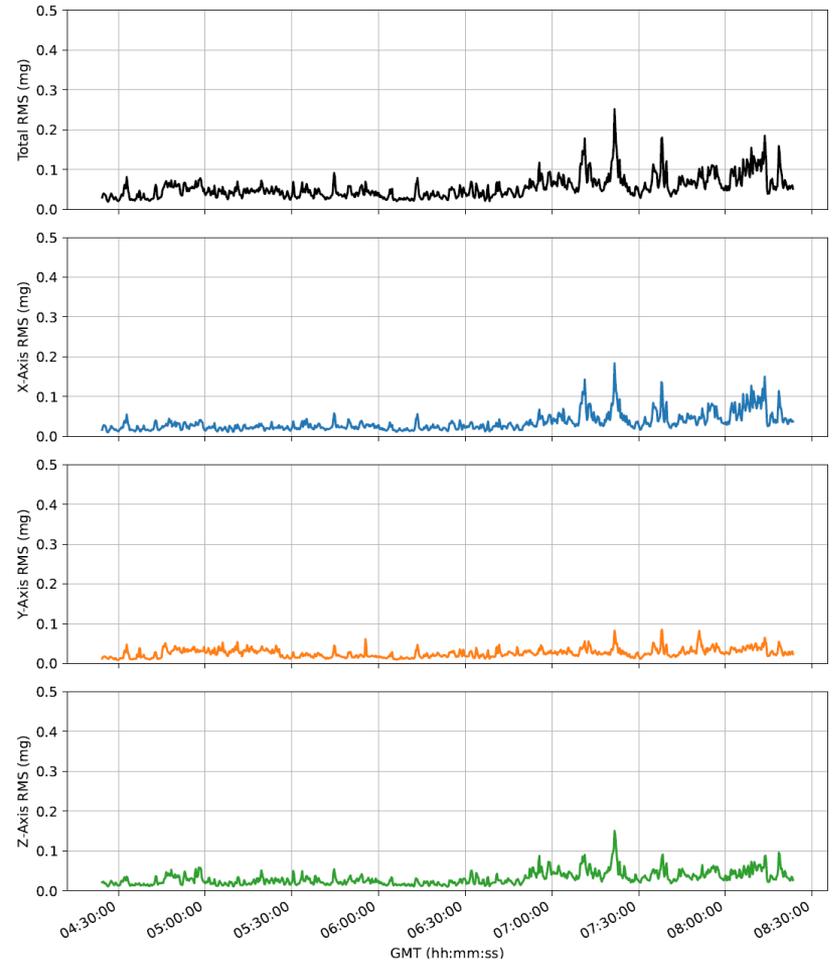
SAMS Sensor 121f04 at LAB1P2

121f04006 Narrow Band RMS Accel. vs Time
Interval: Size = 57.69, Step = 15.44 sec.
Frequency Band: $0.01 \leq f < 6.0$ Hz
Start GMT 2025-01-02, 002/04:23:52.000 (span = 00:04:00:00)



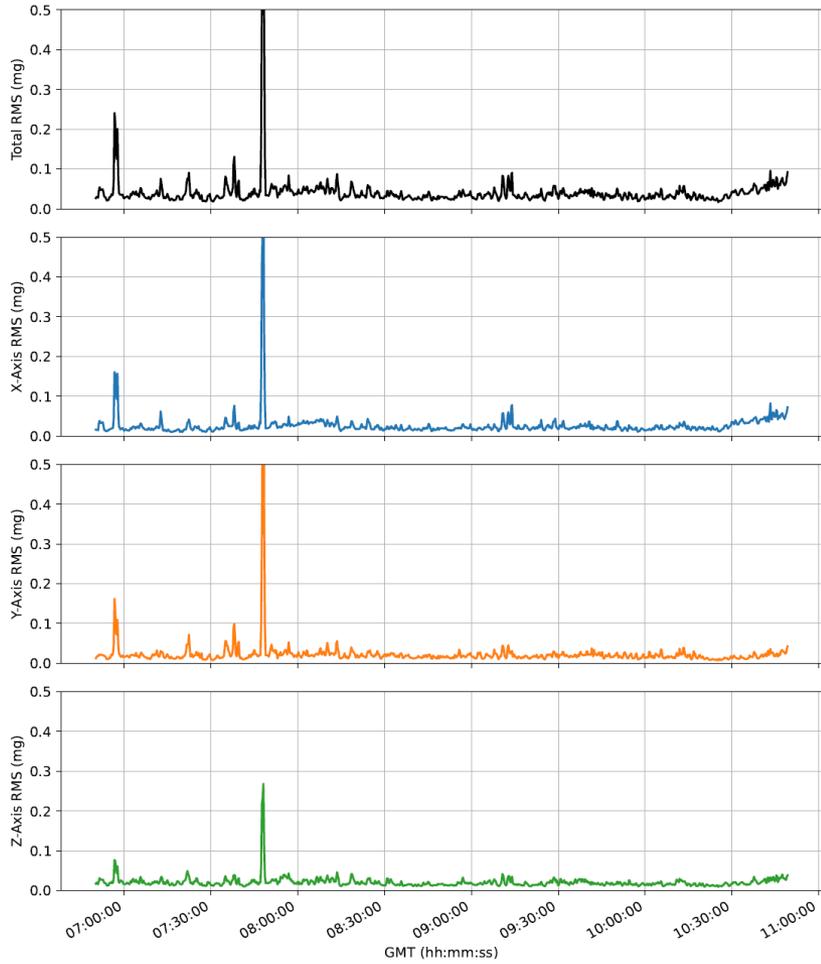
SAMS Sensor 121f08 at COL1A3

121f08006 Narrow Band RMS Accel. vs Time
Interval: Size = 57.69, Step = 15.44 sec.
Frequency Band: $0.01 \leq f < 6.0$ Hz
Start GMT 2025-01-02, 002/04:23:52.000 (span = 00:04:00:00)



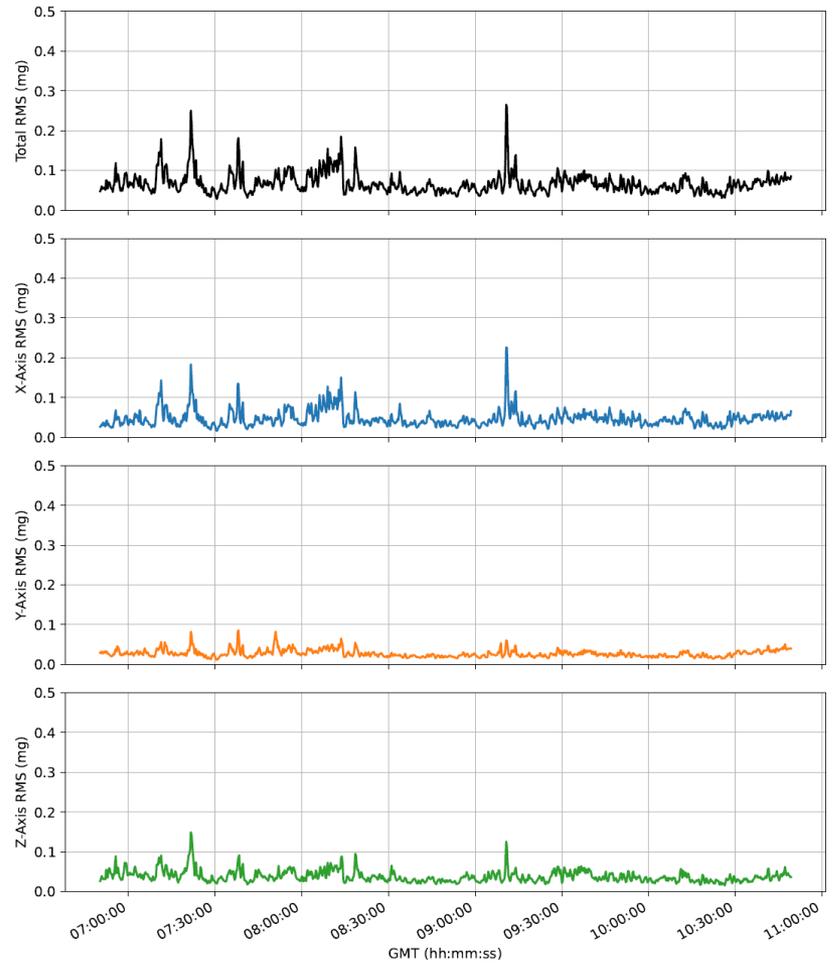
SAMS Sensor 121f04 at LAB1P2

121f04006 Narrow Band RMS Accel. vs Time
Interval: Size = 57.69, Step = 15.44 sec.
Frequency Band: 0.01 <= f < 6.0 Hz
Start GMT 2025-01-02, 002/06:49:44.000 (span = 00:04:00:00)



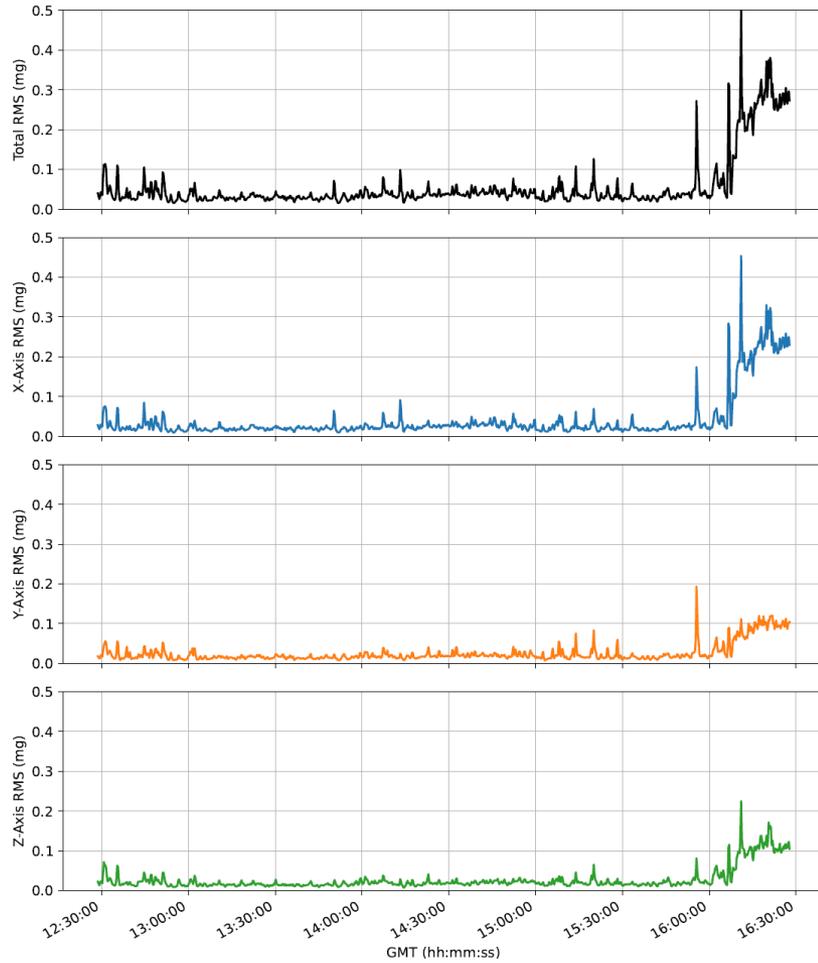
SAMS Sensor 121f08 at COL1A3

121f08006 Narrow Band RMS Accel. vs Time
Interval: Size = 57.69, Step = 15.44 sec.
Frequency Band: 0.01 <= f < 6.0 Hz
Start GMT 2025-01-02, 002/06:49:44.000 (span = 00:04:00:00)



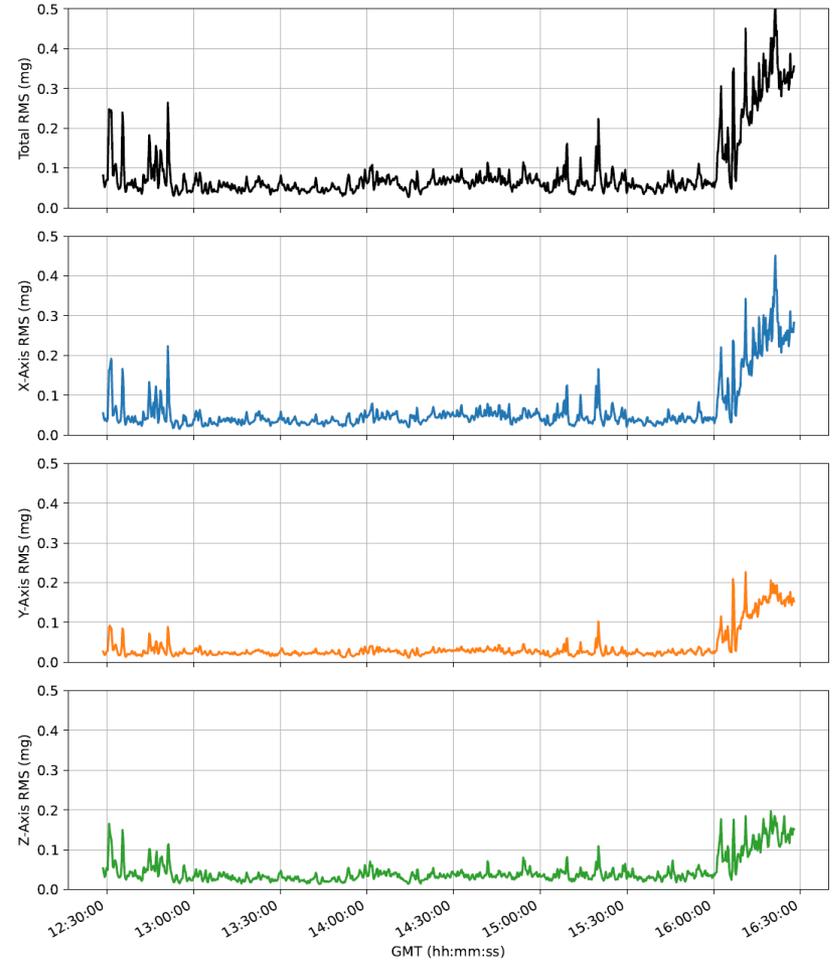
SAMS Sensor 121f04 at LAB1P2

121f04006 Narrow Band RMS Accel. vs Time
Interval: Size = 57.69, Step = 15.44 sec.
Frequency Band: $0.01 \leq f < 6.0$ Hz
Start GMT 2025-01-02, 002/12:28:15.000 (span = 00:04:00:00)



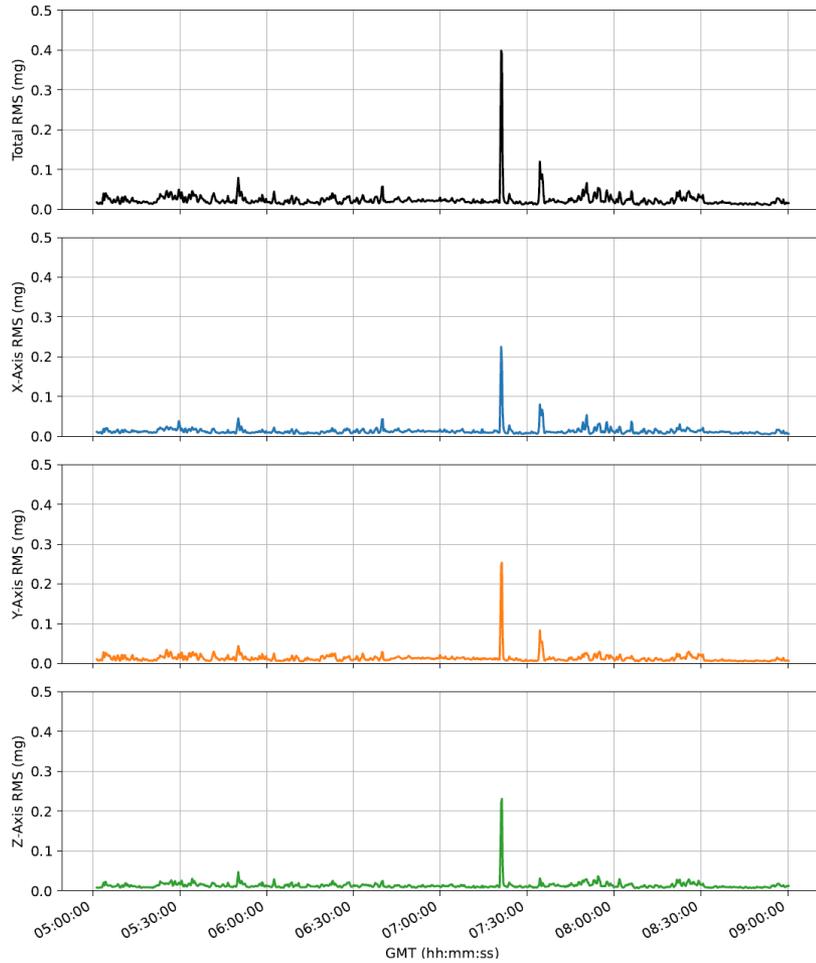
SAMS Sensor 121f08 at COL1A3

121f08006 Narrow Band RMS Accel. vs Time
Interval: Size = 57.69, Step = 15.44 sec.
Frequency Band: $0.01 \leq f < 6.0$ Hz
Start GMT 2025-01-02, 002/12:28:15.000 (span = 00:04:00:00)



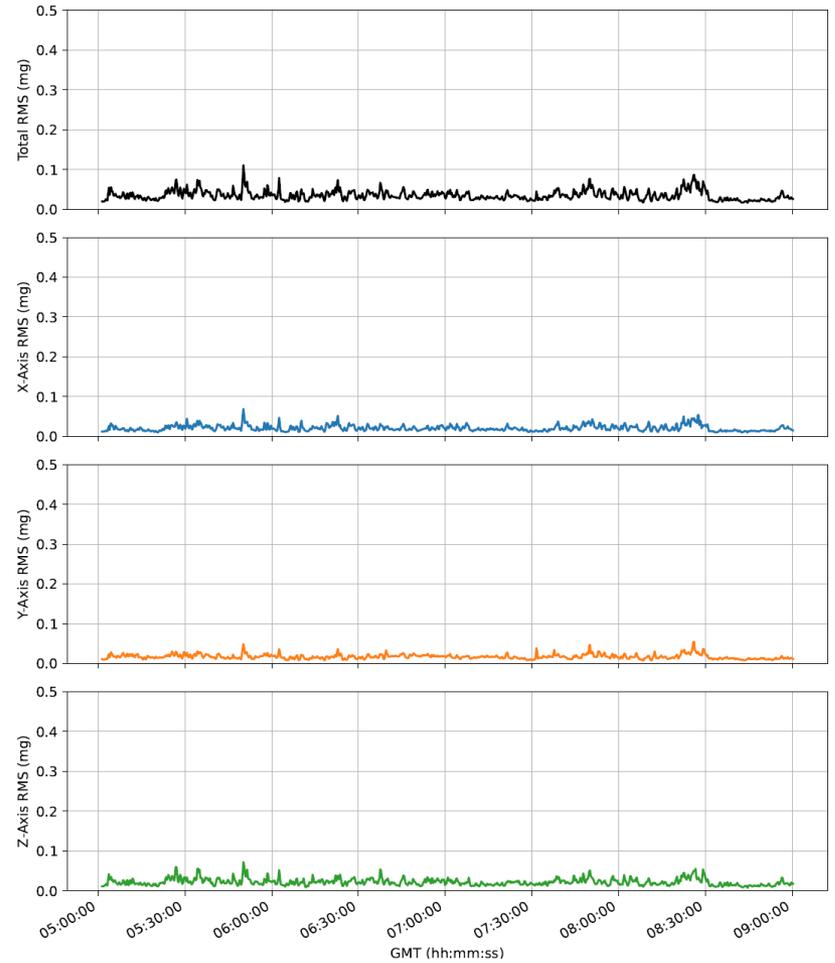
SAMS Sensor 121f04 at LAB1P2

121f04006 Narrow Band RMS Accel. vs Time
Interval: Size = 57.69, Step = 15.44 sec.
Frequency Band: 0.01 <= f < 6.0 Hz
Start GMT 2025-01-04, 004/05:00:51.000 (span = 00:04:00:00)



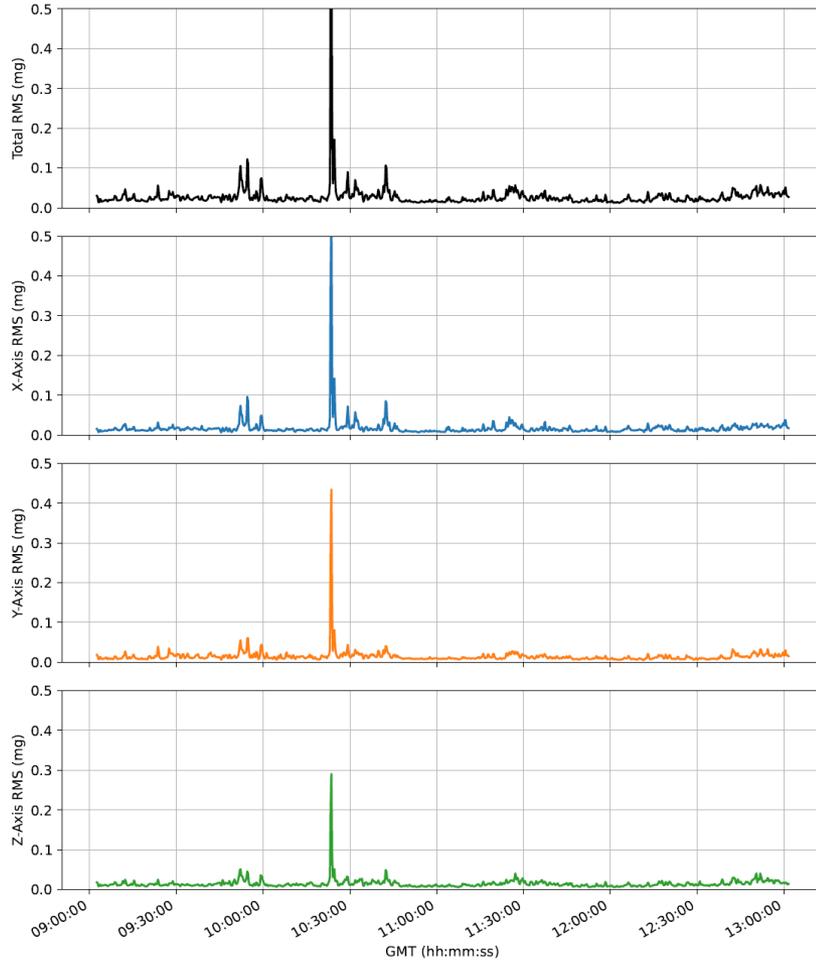
SAMS Sensor 121f08 at COL1A3

121f08006 Narrow Band RMS Accel. vs Time
Interval: Size = 57.69, Step = 15.44 sec.
Frequency Band: 0.01 <= f < 6.0 Hz
Start GMT 2025-01-04, 004/05:00:51.000 (span = 00:04:00:00)



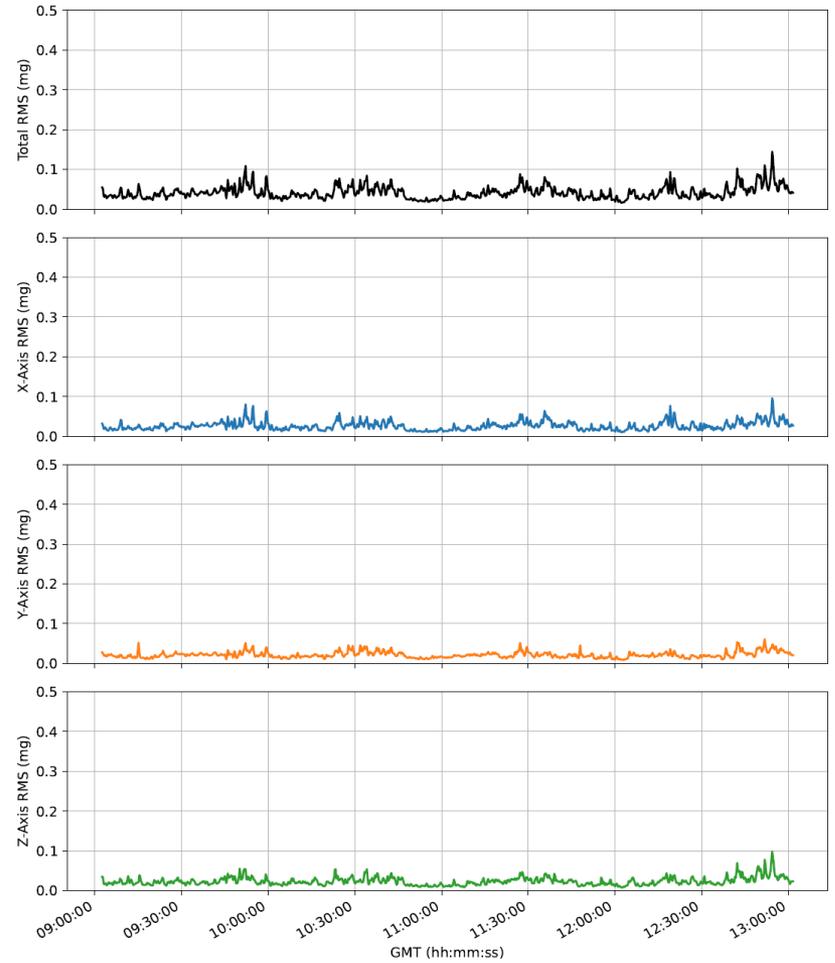
SAMS Sensor 121f04 at LAB1P2

121f04006 Narrow Band RMS Accel. vs Time
Interval: Size = 57.69, Step = 15.44 sec.
Frequency Band: $0.01 \leq f < 6.0$ Hz
Start GMT 2025-01-05, 005/09:02:04.000 (span = 00:04:00:00)



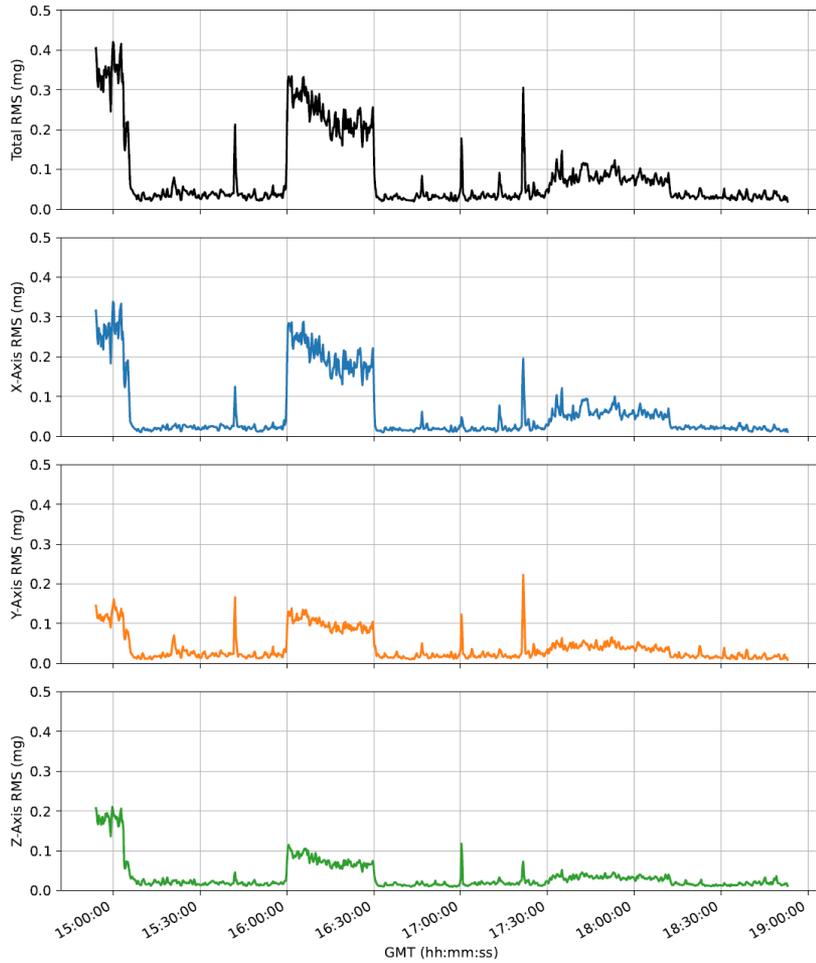
SAMS Sensor 121f08 at COL1A3

121f08006 Narrow Band RMS Accel. vs Time
Interval: Size = 57.69, Step = 15.44 sec.
Frequency Band: $0.01 \leq f < 6.0$ Hz
Start GMT 2025-01-05, 005/09:02:04.000 (span = 00:04:00:00)



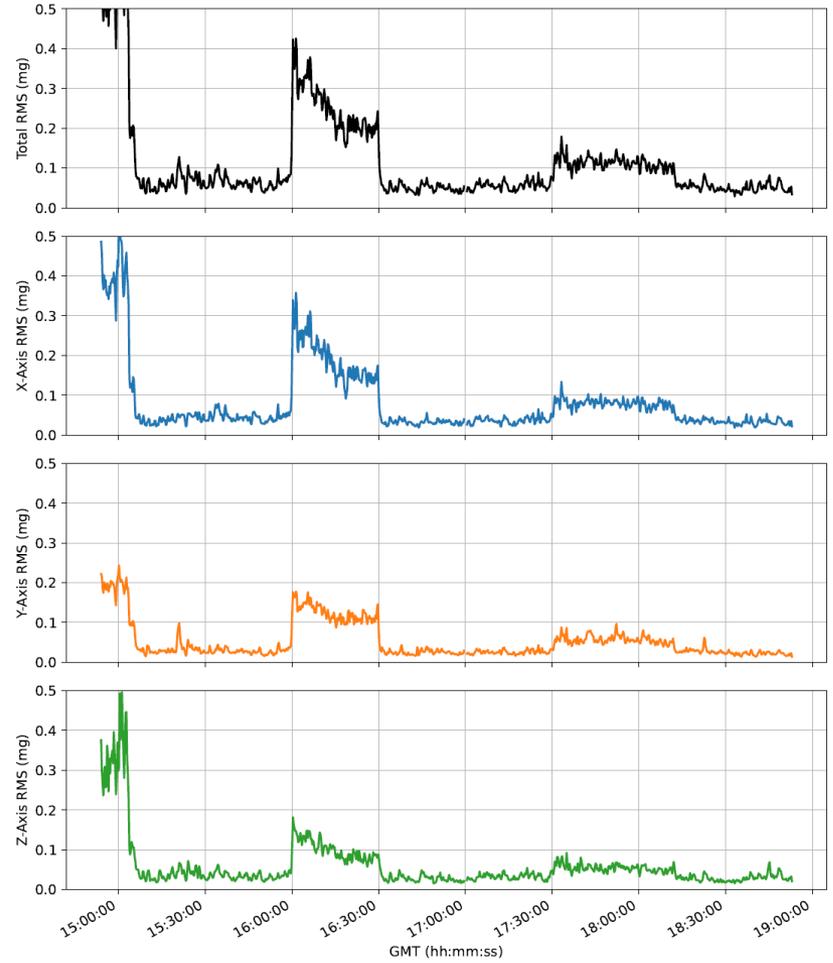
SAMS Sensor 121f04 at LAB1P2

121f04006 Narrow Band RMS Accel. vs Time
Interval: Size = 57.69, Step = 15.44 sec.
Frequency Band: $0.01 \leq f < 6.0$ Hz
Start GMT 2025-01-05, 005/14:53:28.000 (span = 00:04:00:00)



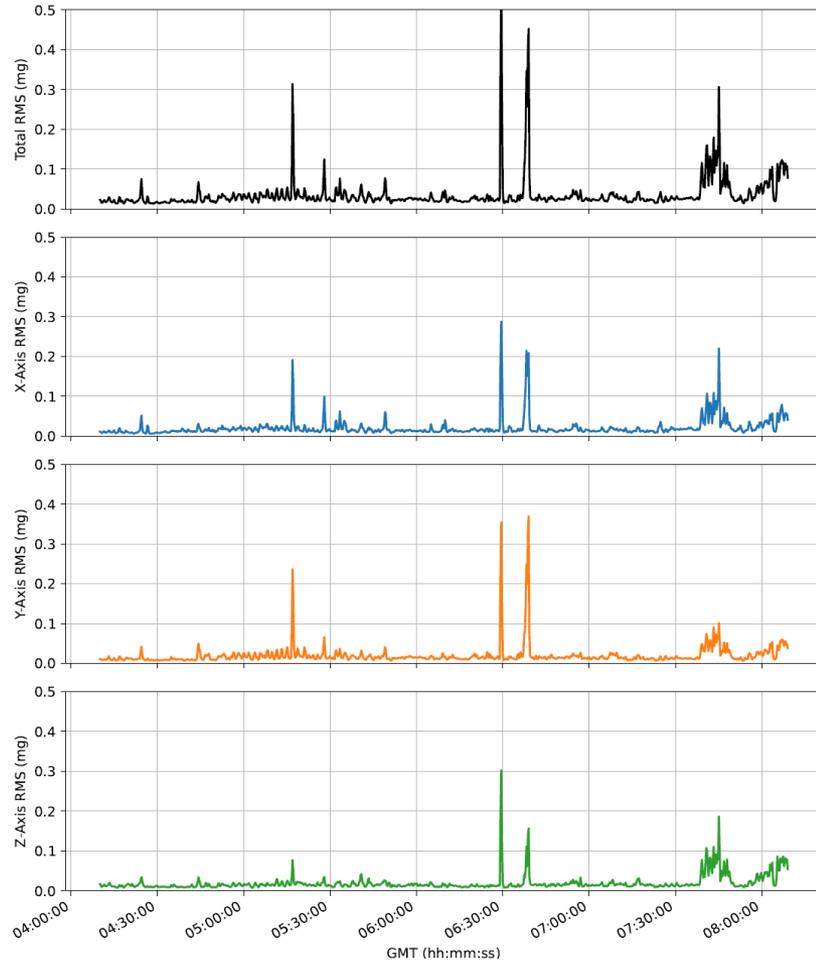
SAMS Sensor 121f08 at COL1A3

121f08006 Narrow Band RMS Accel. vs Time
Interval: Size = 57.69, Step = 15.44 sec.
Frequency Band: $0.01 \leq f < 6.0$ Hz
Start GMT 2025-01-05, 005/14:53:28.000 (span = 00:04:00:00)



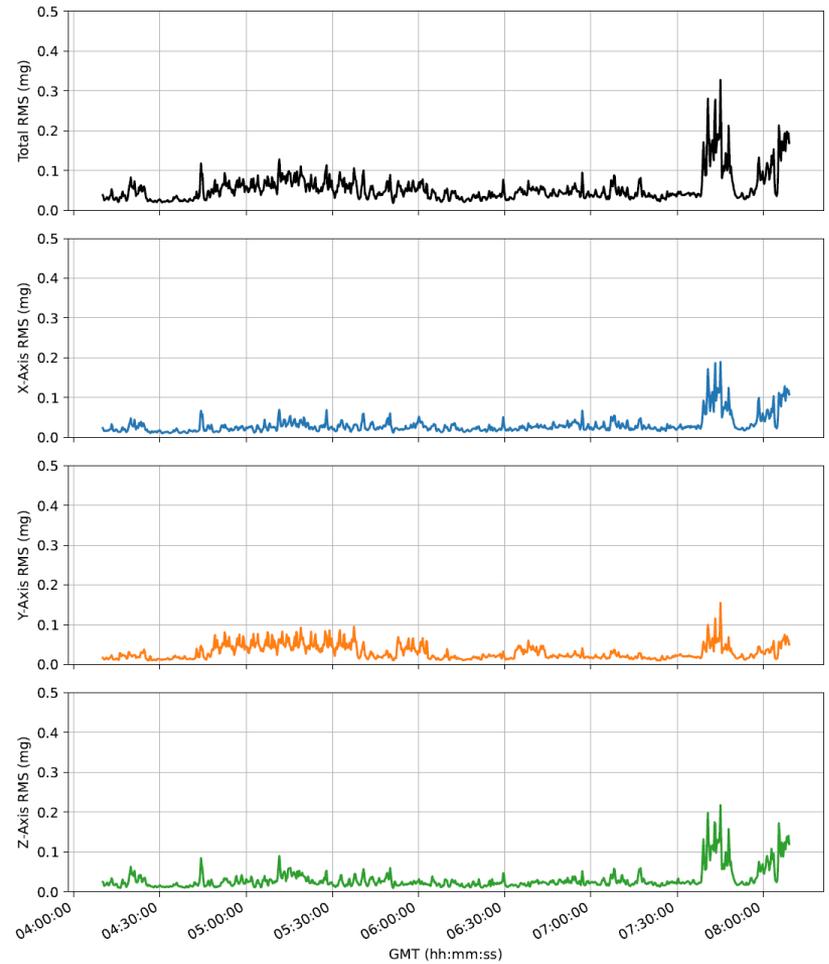
SAMS Sensor 121f04 at LAB1P2

121f04006 Narrow Band RMS Accel. vs Time
Interval: Size = 57.69, Step = 15.44 sec.
Frequency Band: $0.01 \leq f < 6.0$ Hz
Start GMT 2025-01-06, 006/04:09:33.000 (span = 00:04:00:00)



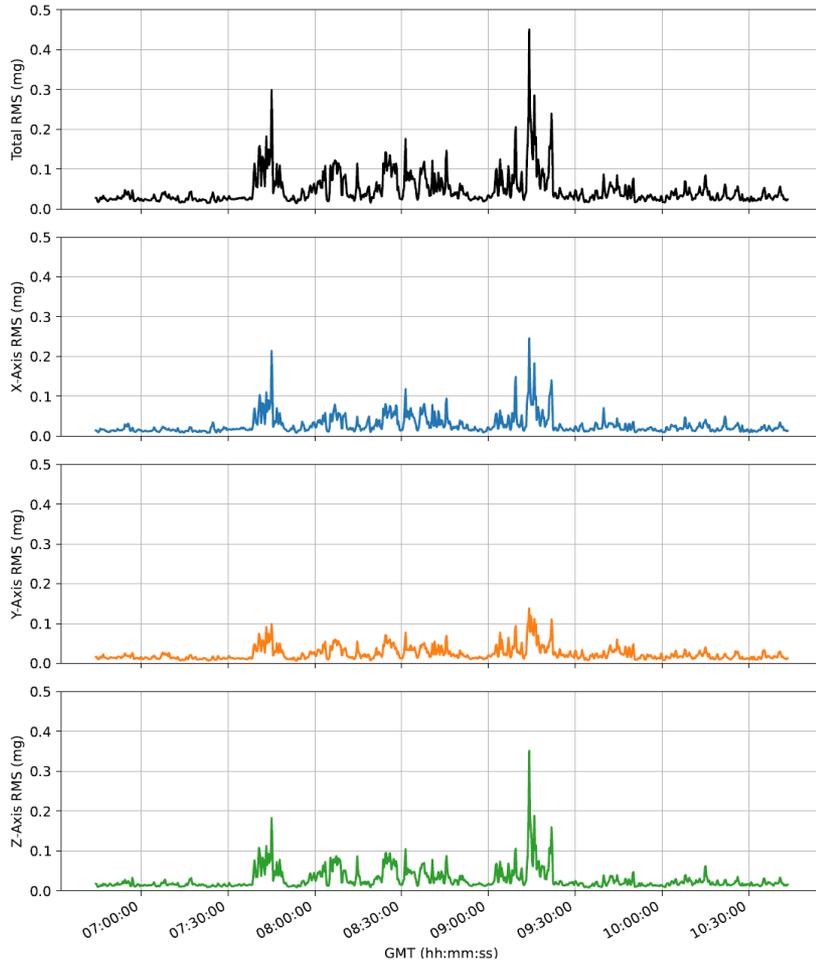
SAMS Sensor 121f08 at COL1A3

121f08006 Narrow Band RMS Accel. vs Time
Interval: Size = 57.69, Step = 15.44 sec.
Frequency Band: $0.01 \leq f < 6.0$ Hz
Start GMT 2025-01-06, 006/04:09:33.000 (span = 00:04:00:00)



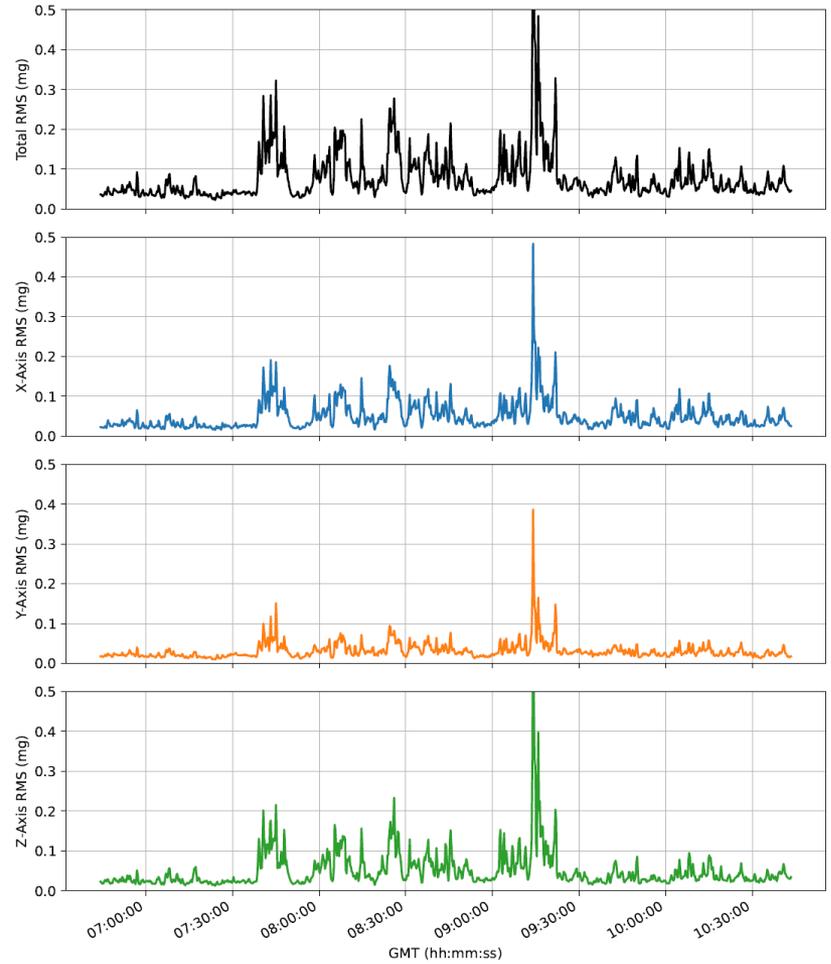
SAMS Sensor 121f04 at LAB1P2

121f04006 Narrow Band RMS Accel. vs Time
Interval: Size = 57.69, Step = 15.44 sec.
Frequency Band: 0.01 <= f < 6.0 Hz
Start GMT 2025-01-06, 006/06:43:53.000 (span = 00:04:00:00)



SAMS Sensor 121f08 at COL1A3

121f08006 Narrow Band RMS Accel. vs Time
Interval: Size = 57.69, Step = 15.44 sec.
Frequency Band: 0.01 <= f < 6.0 Hz
Start GMT 2025-01-06, 006/06:43:53.000 (span = 00:04:00:00)



Conclusions

- In general, analysis of SAMS measurements in 2 of the main labs (LAB and COL) during 7 of the 8 Teal CEVIS exercise sessions, we saw no indications of discernible impact on the vibratory regime below 6 Hz at either location.
- The last of the 8 sessions on GMT 2025-01-06, there was clearly an exercise session underway, but the vibratory impact is not likely due to CEVIS.