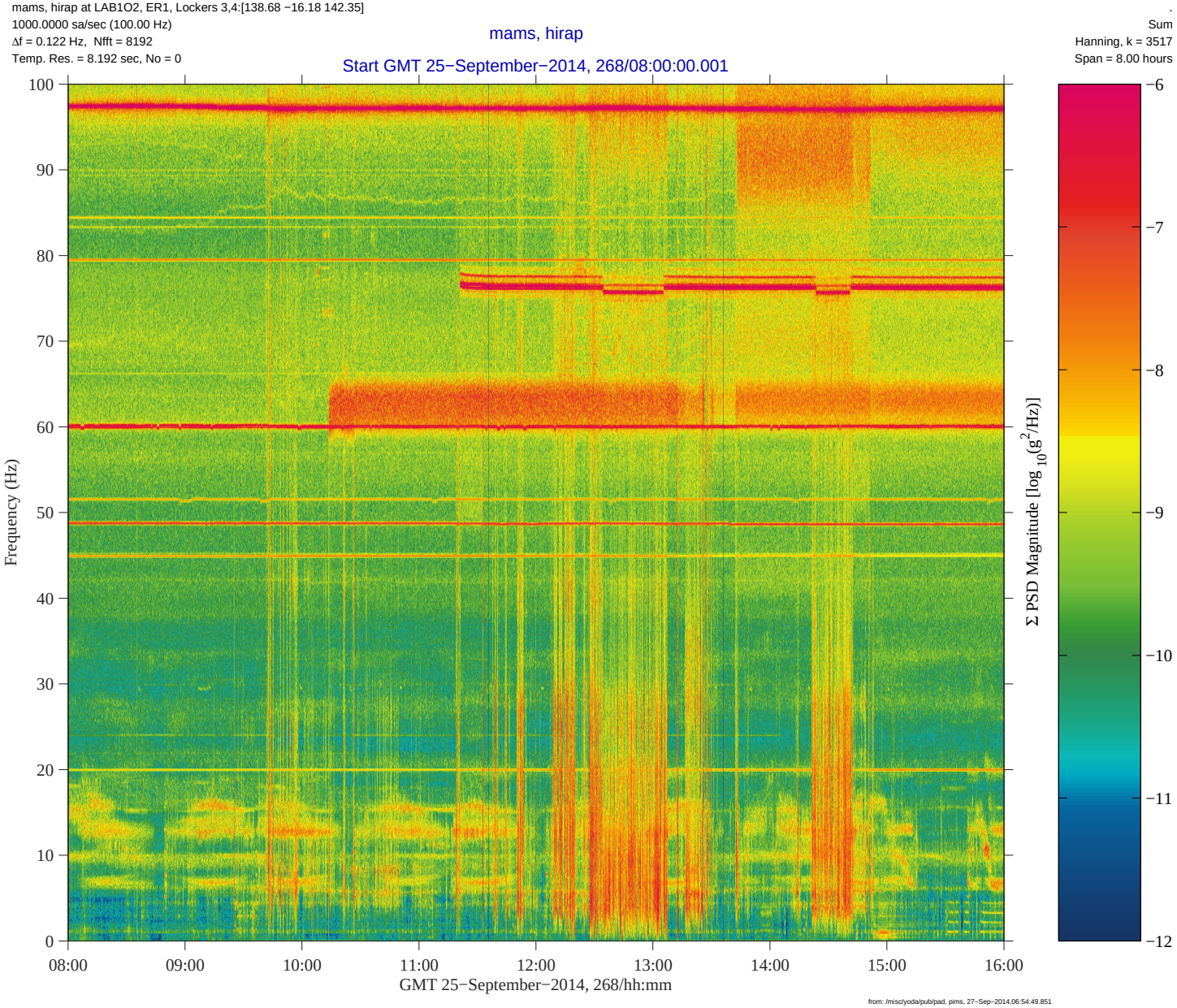
Install Rodent Research Habitat Qualify



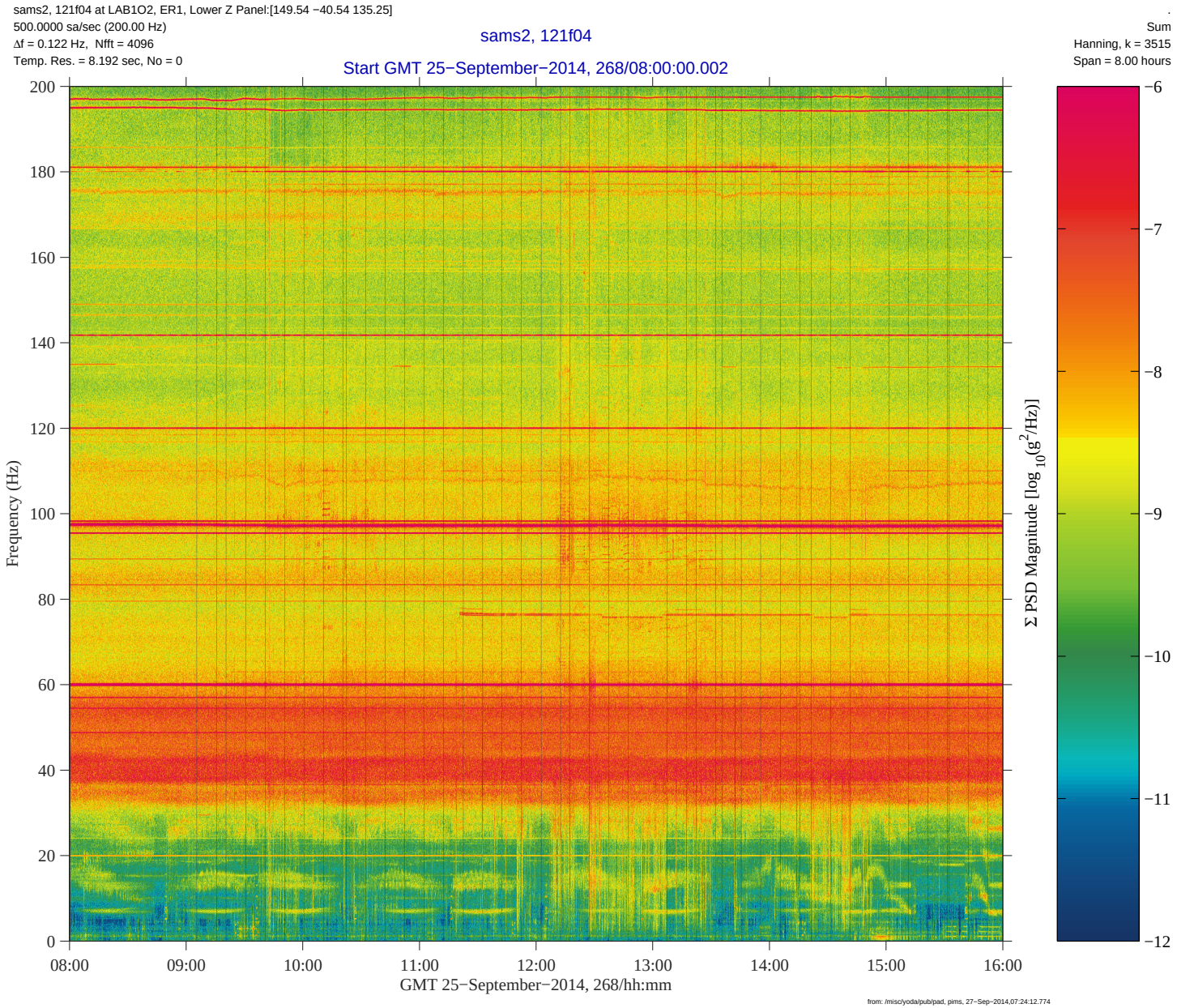
Description	
Sensor	MAMS hirap 1000.0 sa/sec, 100 Hz
Location	LAB1O2, ER1, Lockers 3,4
Plot Type	Spectrogram

Notes:

- On GMT 25-Sep-2014, observation of the real-time spectrogram display for MAMS HiRAP showed strong vibratory signatures startup, deemed most likely in the USL. This plot is an off-line version of that spectrogram.
- Notice at about 10:15, a sudden change in vibrations near 60 Hz. This is probably unrelated and likely GLACIER ops.
- Notice at about 11:15, startup of a twin pair of narrowband spectral peaks near 76 Hz.
- Especially take notice of the red, vertical streaks between about 10:00 and 15:00.
- An email reply from the OC indicated "**the crew was installing the Rodent Research Habitats in ER1, Locker 7, and ER2, Locker 8** and transferring the mice, powering up ER laptop software applications and video" around this time.

Regime:	Vibratory
Category:	Crew
Source:	Install Rodent Research Habitat

Install Rodent Research Habitat Qualify



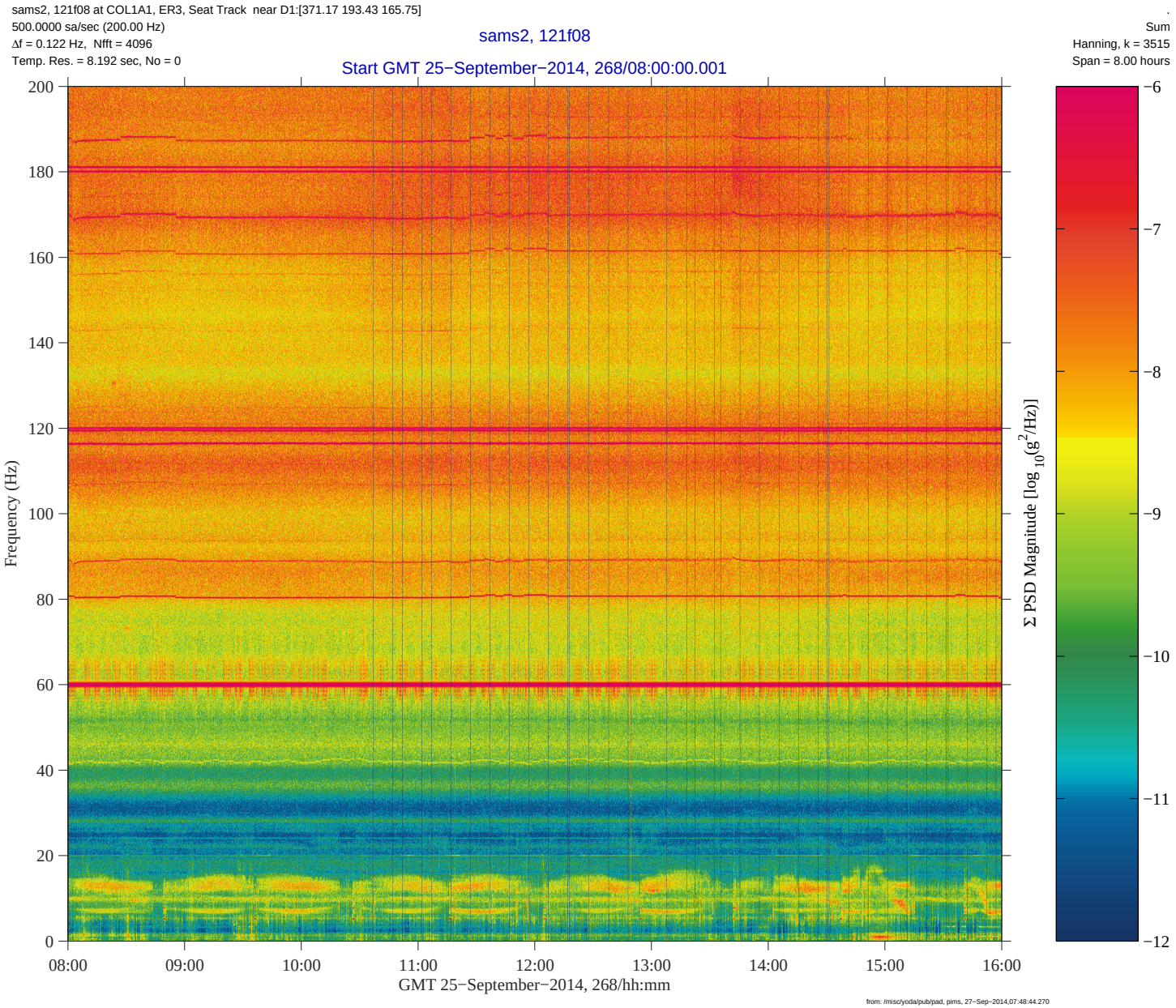
Description	
Sensor	SAMS 121f04 500.0 sa/sec, 200.0 Hz
Location	LAB1O2, ER1, Lower Z Panel
Plot Type	Spectrogram

Notes:

- This plot shows a spectrogram of SAMS data from a sensor near ER1 for same time frame as the previous plot of HiRAP.
- This spectrogram also shows similar, notable signatures: (1) startup of narrowband spectral peaks near 76 Hz, and (2) impulsive, transient accelerations that show up as red, vertical streaks between about 10:00-15:00.

Regime:	Vibratory
Category:	Crew
Source:	Install Rodent Research Habitat

Install Rodent Research Habitat Qualify



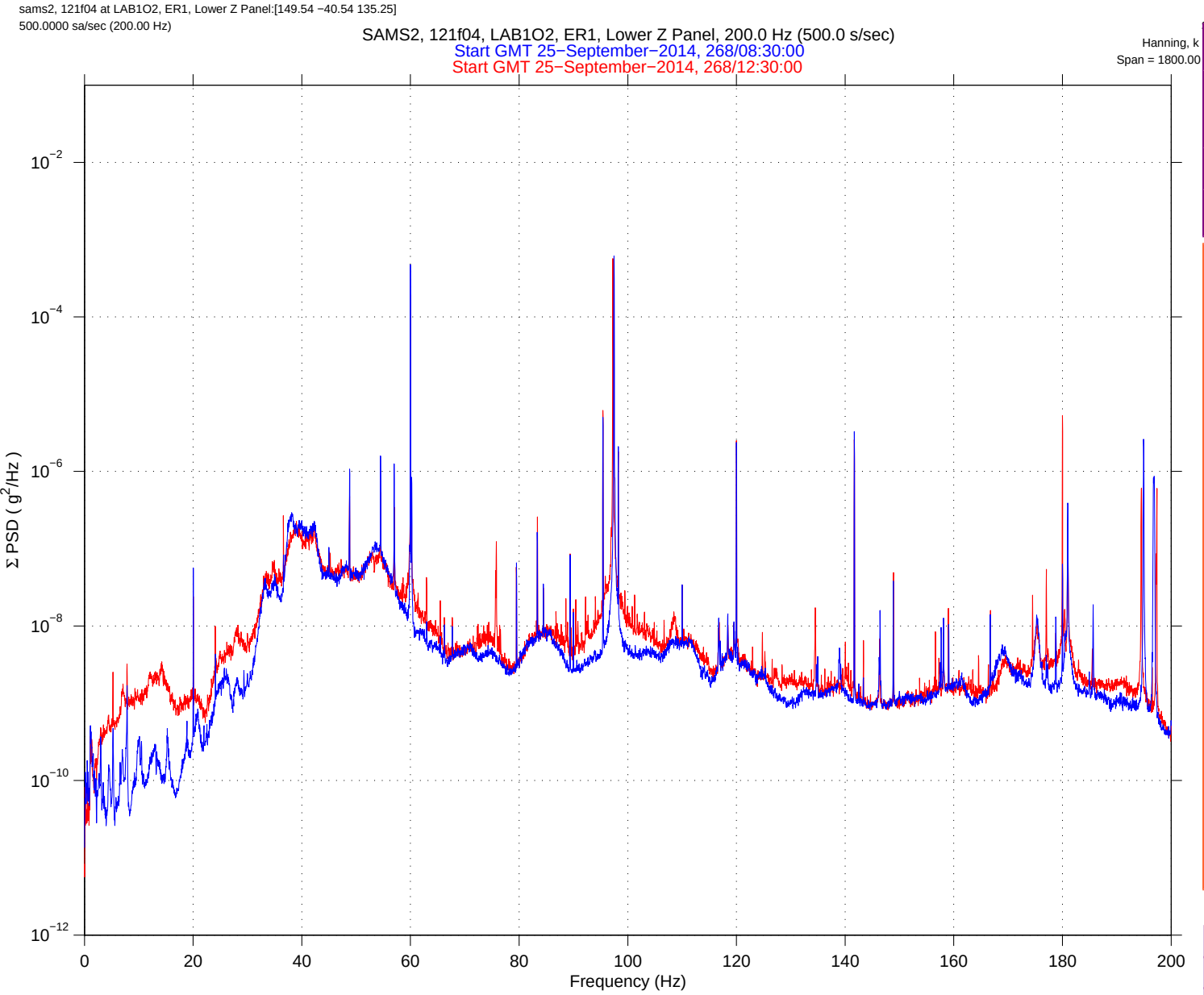
Description	
Sensor	SAMS 121f08 500.0 sa/sec, 200.0 Hz
Location	COL1A1, ER3, Seat Track near D1
Plot Type	Spectrogram

Notes:

- This is a spectrogram of SAMS data from a sensor far away from the crew install activity. It was SAMS data recorded in ER3, which is located in the Columbus module.
- This plot is of the same time frame as the previous ones for HiRAP and SAMS in USL.
- These SAMS measurements do not readily show the notable “install” signatures: (1) no startup of narrowband spectral peaks near 76 Hz, and (2) no impulsive, transient accelerations that would show up as red, vertical streaks.

Regime:	Vibratory
Category:	Crew
Source:	Install Rodent Research Habitat

Install Rodent Research Habitat Qualify



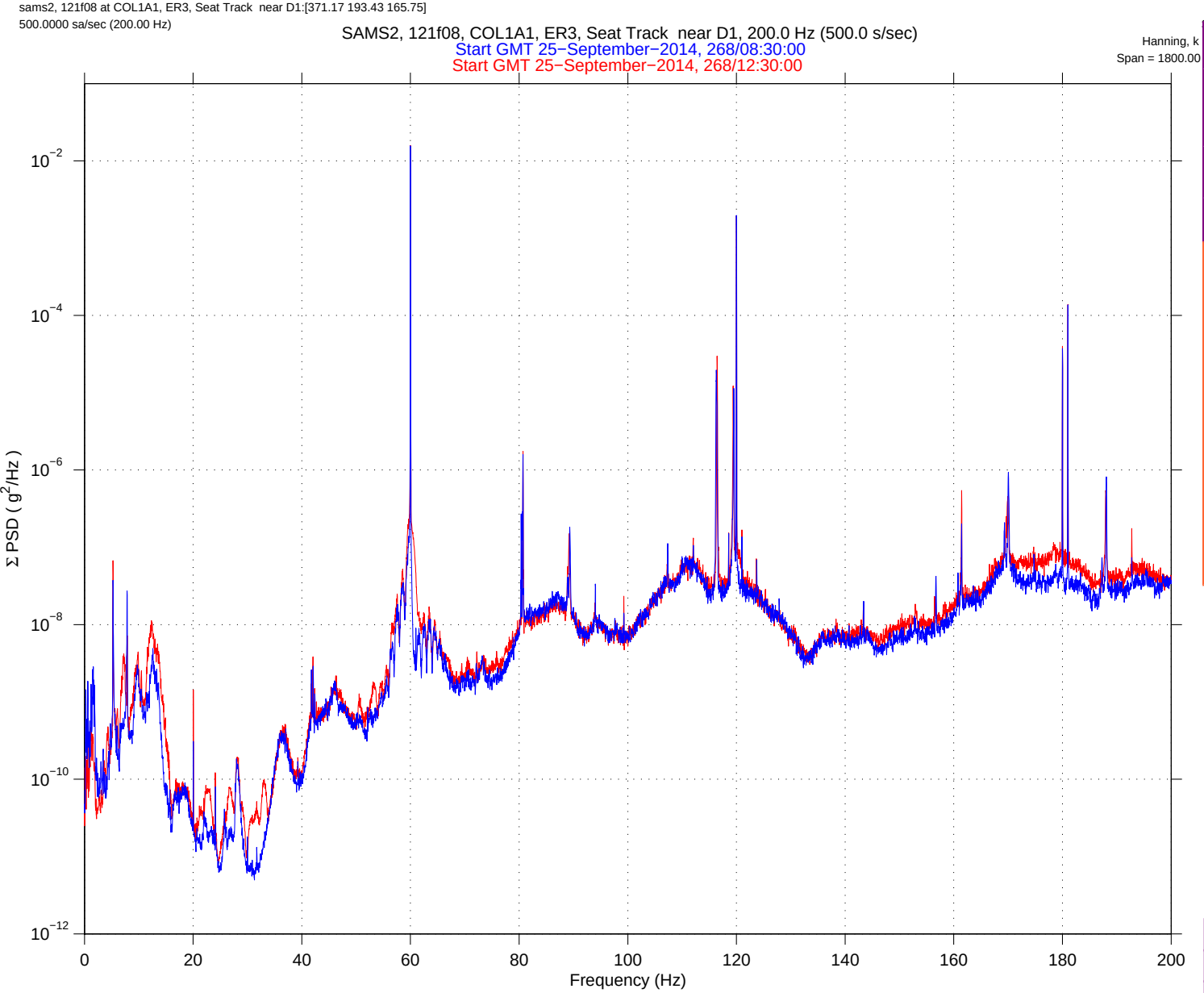
Description	
Sensor	SAMS 121f04 500.0 sa/sec, 200.0 Hz
Location	LAB1O2, ER1, Lower Z Panel
Plot Type	Power Spectral Density

Notes:

- For comparison, 2 half-hour spans: (1) before the crew was doing install and, (2) during the install are represented in the 2 PSDs shown here. The blue trace shows acceleration spectral summary before the crew activity. The red trace shows acceleration spectral summary during the crew activity.
- Two notable features from the comparison: (1) the spectral peak(s) in the red trace near 76 Hz, which do not show up in the blue trace, and (2) the frequency band between about 5 and 30 Hz is heightened in the red trace relative to the blue.
- The spectral peak near 76 Hz is not fully identified here, but appears related to the Rodent Research Habitat ops.
- The broadband excitement noted in the red trace during the crew activity is attributable to crew or equipment impacting with space station structure, which results in impulsive accelerations, hence broadband excitation.

Regime:	Vibratory
Category:	Crew
Source:	Install Rodent Research Habitat

Install Rodent Research Habitat Qualify



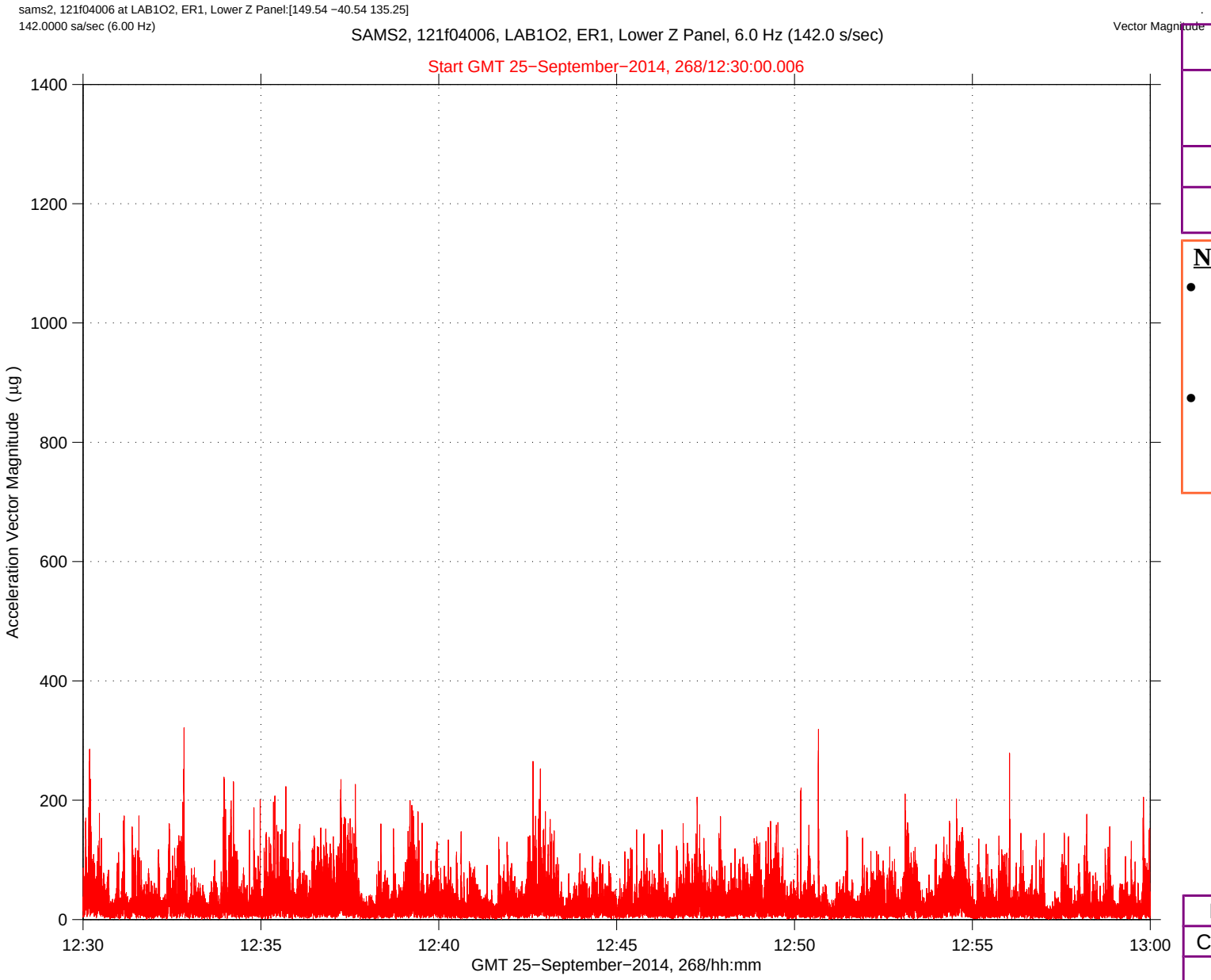
Description	
Sensor	SAMS 121f08 500.0 sa/sec, 200.0 Hz
Location	COL1A1, ER3, Seat Track near D1
Plot Type	Power Spectral Density

Notes:

- The comparison drawn on the previous page was done using a SAMS sensor in the USL, near the crew activity around ER1.
- The plot on this page, however, is the PSD comparison for a SAMS sensor far away from the crew activity, in the Columbus module, on ER3.
- Neither of the 2 features cited for the SAMS sensor near the crew activity in the USL show up in these SAMS sensor measurements in the Columbus module.

Regime:	Vibratory
Category:	Crew
Source:	Install Rodent Research Habitat

Install Rodent Research Habitat Quantify



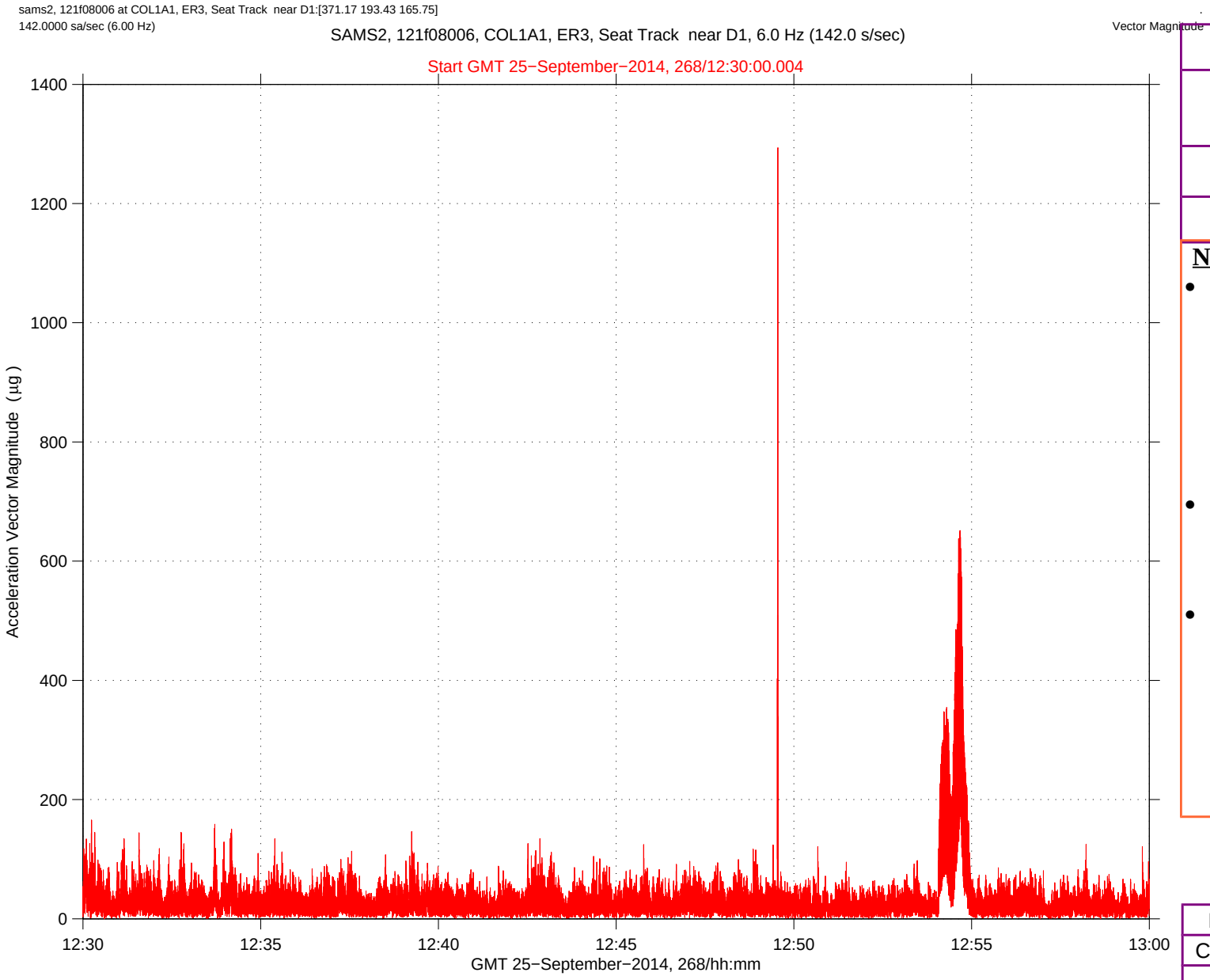
Description	
Sensor	SAMS 121f04006 142.00 sa/sec, 6.00 Hz
Location	LAB1O2, ER1, Lower Z Panel
Plot Type	Acceleration vs. Time

Notes:

- To further our analysis, we now look at acceleration vector magnitude values versus time for a half hour during the crew install period.
- It is important to note that the data shown here were measured nearby the crew activity during install and have been low-pass filtered at 6 Hz.

Regime:	Vibratory
Category:	Crew
Source:	Install Rodent Research Habitat

Install Rodent Research Habitat Quantify



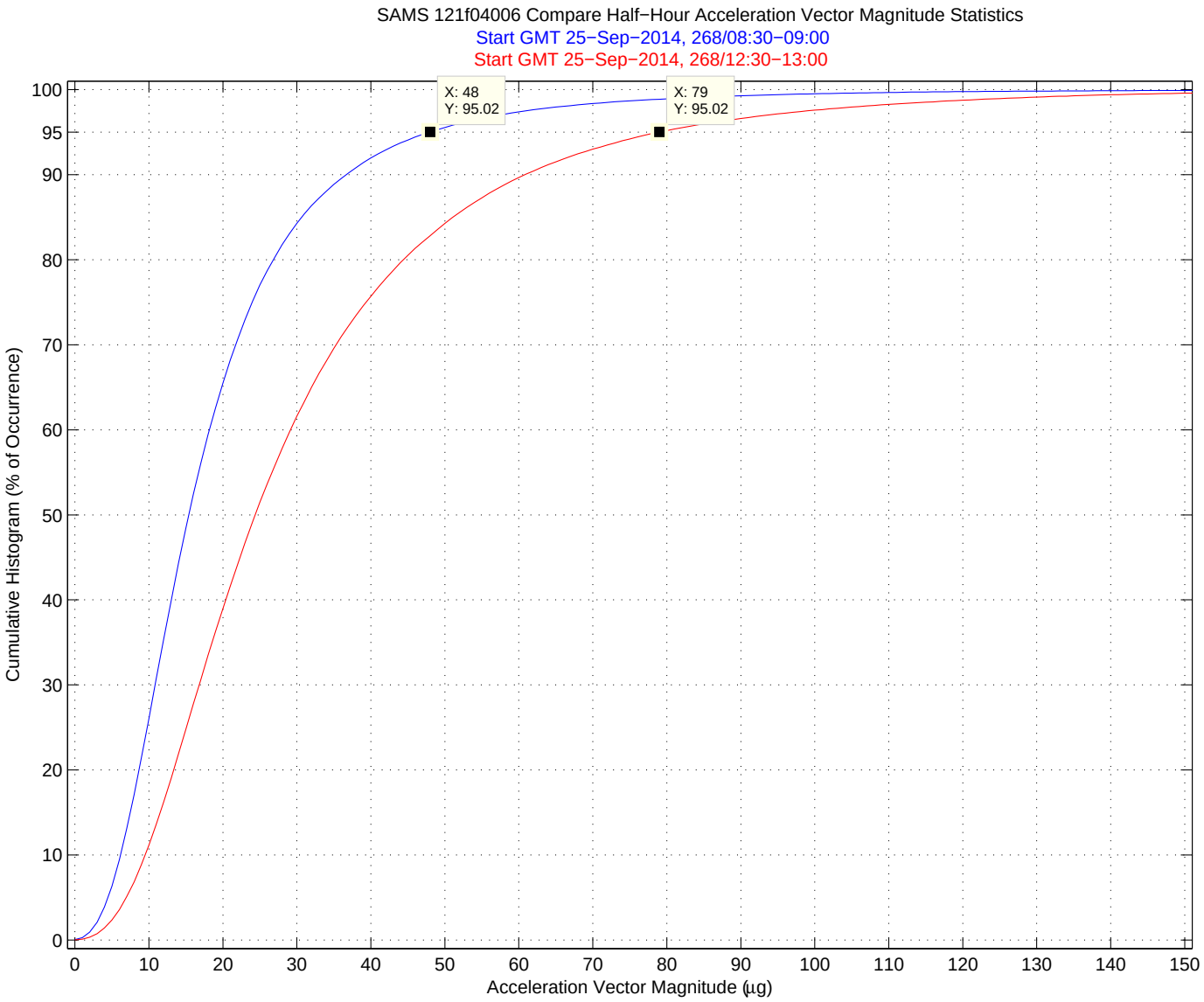
Description	
Sensor	SAMS 121f08006 142.00 sa/sec, 6.00 Hz
Location	COL1A1, ER3, Seat Track near D1
Plot Type	Acceleration vs. Time

Notes:

- To see if the crew activity in the USL was transmitted significantly through space station structure to the Columbus module, we again plot acceleration vector magnitude versus time. Here though, we do so using SAMS data measured in the Columbus module for the same half hour during the crew install period.
- It is now important to note that the data shown here were measured far from the crew activity during install and have been low-pass filtered at 6 Hz.
- If you compare the plot of SAMS data in Columbus on this page to SAMS data in the USL on the previous page, you can see the impulsive, transient accelerations associated with the crew activity on the previous page are quite distinct relative to what we see here. This point will be better seen on a subsequent page.

Regime:	Vibratory
Category:	Crew
Source:	Install Rodent Research Habitat

Install Rodent Research Habitat Quantify



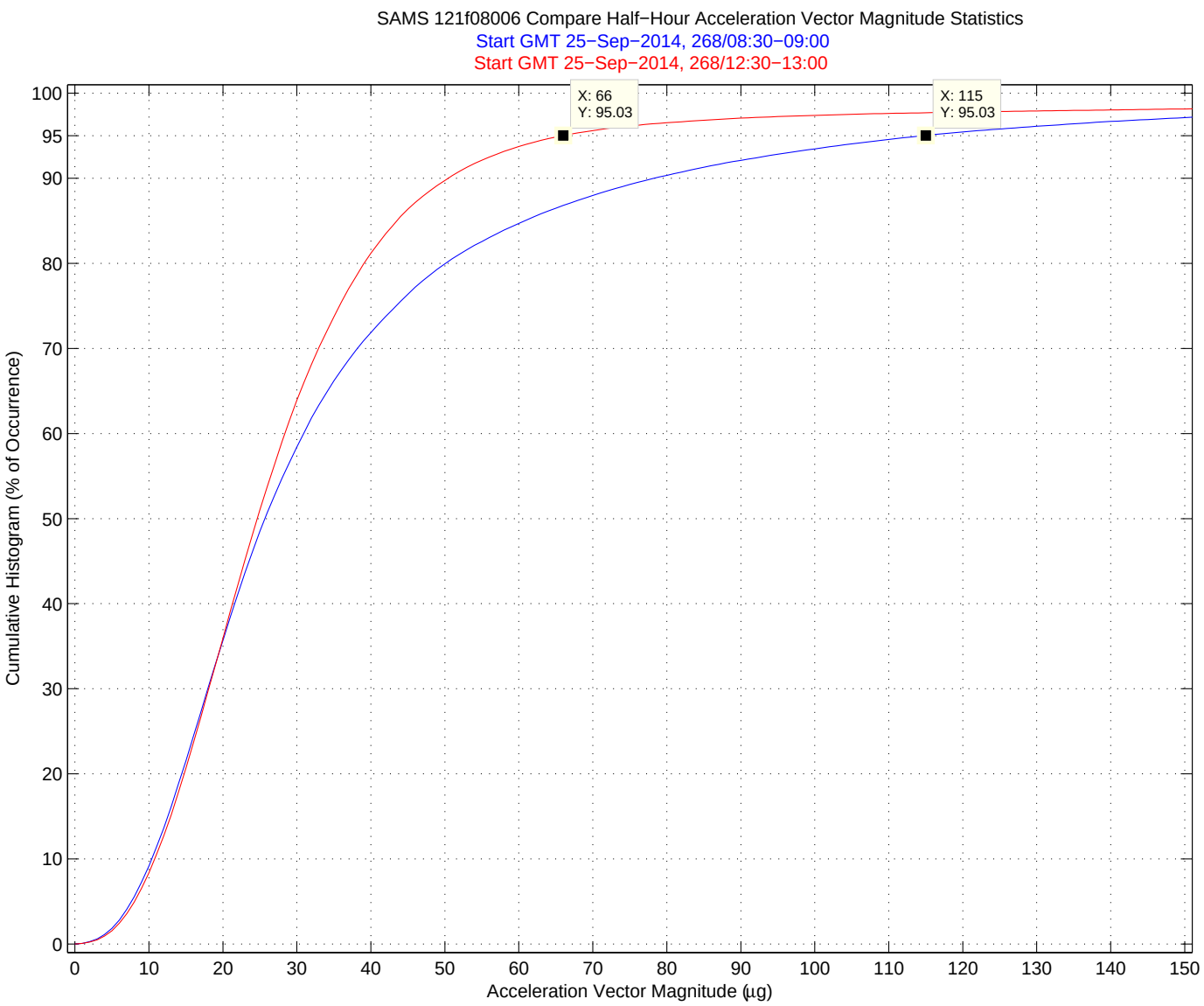
Description	
Sensor	SAMS 121f04006 142.00 sa/sec, 6.00 Hz
Location	LAB1O2, ER1, Lower Z Panel
Plot Type	Cumulative Histogram

Notes:

- To give a quantitave summary for comparison, we show cumulative histograms here for the 2 half-hour periods previously described for SAMS measurements made **nearby in the USL**. The BLUE trace is the cumulative histogram for acceleration vector magnitudes (below 6 Hz) for the half-hour period BEFORE the crew activity, while the RED trace is likewise for the half-hour period DURING the crew activity.
- The 2 data annotations that adorn the plot's 2 traces mark the acceleration vector magnitude 95th percentile for the 2 half-hour periods, respectively. These values will be tabulated on a subsequent page.

Regime:	Vibratory
Category:	Crew
Source:	Install Rodent Research Habitat

Install Rodent Research Habitat Quantify



Description	
Sensor	SAMS 121f08006 142.00 sa/sec, 6.00 Hz
Location	COL1A1, ER3, Seat Track near D1
Plot Type	Cumulative Histogram

Notes:

- We now show cumulative histograms here for the 2 half-hour periods previously described, but now for the SAMS measurements made (**far away**) in the Columbus module. The BLUE trace is the cumulative histogram for acceleration vector magnitudes (below 6 Hz) for the half-hour period BEFORE the crew activity, while the RED trace is likewise for the half-hour period DURING the crew activity.
- The 2 data markers now capture the acceleration vector magnitude 95th percentile for the 2 half-hour periods for this sensor, respectively. These too will be tabulated on a subsequent page.

Regime:	Vibratory
Category:	Crew
Source:	Install Rodent Research Habitat

Install Rodent Research Habitat
Ancillary Notes

Rodent Research Overview

The Rodent Research hardware system includes the Transporter, Rodent Habitat, Life Support, and Access Unit. The Transporter houses rodents during ascent to the ISS, and continues to house rodents on the ISS for long-duration missions. The Access Unit interfaces with either the Transporter or Habitat to allow handling and transfer of animals. Exposure to spaceflight conditions has been shown to result in alterations to many physiological systems of humans and animals. Ground-based and space flight studies by many investigators demonstrate that the mouse species is a good model for studying the changes in physiological systems in response to space flight. As a result there is a wealth of literature on the physiological impact of space flight and altered gravity on mice that can be compared with future flight data.

The facility houses up to 10 mice for up to 30 days per unit and additional testing in work to increase this to up to 90 days. Its units can be used serially to extend duration of experiment. The crew transfers the mice from the Transporter to the Habitats shortly after docking with the ISS. The crew conducts experiment-specific operations in accordance with the Principal Investigator's requirements.

Routine operations will include: dissections, tissue preservation, blood collection and centrifugation, and bone densitometry. At the end of all experiment operations, the hardware and samples are packed for return. The samples are turned over to the Principal Investigators after splashdown, and the hardware is refurbished for use on another flight.

Acceleration Vector Magnitude 95th Percentile Comparison

	08:30-09:00	12:30-13:00
Sensor	**Before Install**	**During Install**
121f04 (**USL**)	48	79
121f08 (**COL**)	115	66

Root-Mean-Square (RMS) Acceleration Comparisons

	10 < f < 20 Hz		**75.5 < f < 76.7 Hz**	
	08:30-09:00	12:30-13:00	08:30-09:00	12:30-13:00
Sensor	**Before Install**	**During Install**	**Before Install**	**During Install**
121f04 (**USL**)	41.6	122.9	67.5	139.4
121f08 (**COL**)	82.3	132.5	50.5	61.7

The yellow highlighted row best captures a quantitative summary showing: (1) broadband excitation from impulsive activity in the frequency band from 10 to 20 Hz, and (2) the narrowband signature in the frequency band from 75.5 to 76.7 Hz.