

Dedicated Thruster Firing (DTF) Test

GMT 2018-08-16

A Dedicated Thruster Firing (DTF) test was run from the ground and performed to gather data on structural modes during specific sets of thruster firings. The test lasted approximately 10-15 minutes with five periodic thruster firings that each lasted less than a second followed by a free drift period. There was a ~4-second free drift period between the first two thruster firings, and a ~3 minute free drift period between the rest of the thruster firings.

During the DTF, there were 3 Space Acceleration Measurement System (SAMS) sensor heads active and collecting data inside the pressurized modules of the International Space Station (ISS) – 2 sensor heads in the US Lab and 1 sensor head in the Columbus module – along with 3 Microgravity Measurement Equipment (MME) sensor heads, all outside of the pressurized modules and on the Japanese Exposed Facility (JEF). The technical narrative and plots on the following pages aim to show a high-level characterization of the data collected by all 6 of these sensor heads during the DTF.

Page 5 through page 7 show SAMS acceleration versus time plots. These data have been inverted (due to an inherent polarity issue) and resampled down to 142 sa/sec in order to be low-pass filtered at 6 Hz to match the cut-off frequency that has been used historically.

Page 8 through page 10 show MME acceleration versus time plots. These data have been resampled down to 100 sa/sec in order to be low-pass filtered at 5 Hz to match the cut-off frequency called out by Loads & Dynamics team at Boeing. *Note that the X-axis data from MME Unit #3 on page 10 appears to be corrupted or unusable.*

Page 11 through page 13 show color spectrograms of the SAMS data up to a maximum frequency of 1 Hz. This plot shows structures, boundaries and patterns in both time and frequency, albeit a bit blurred in time due to the amount of overlap used when computing constituent spectra. Page 13 shows that the SAMS sensor head in the Columbus module registers the structural mode excitation at notably higher levels than the other 2 SAMS sensor heads in the US Lab.

Page 14 through page 23 show power spectral densities below 5 Hz for each of the 6 sensor heads, plus some that show overlay comparisons of various sensor heads.

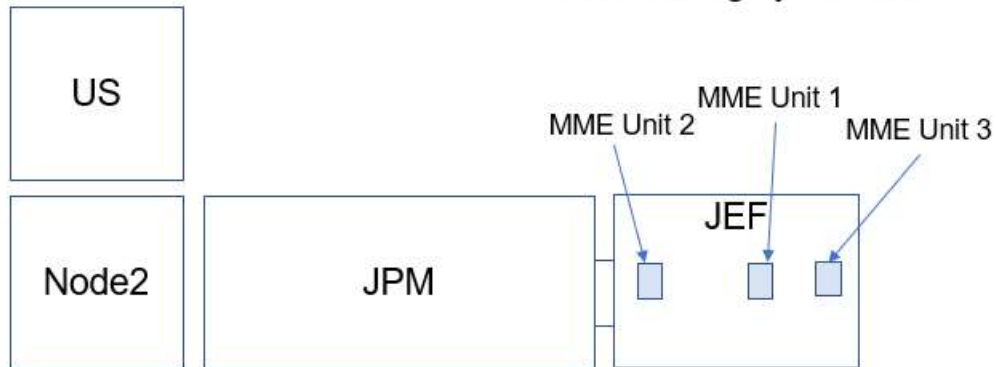
The overlay on page 17 shows that the 2 SAMS sensor heads in the US Lab match very closely, especially below about 3 Hz or so with the exception of a mode near 0.25 Hz and a mode just below 0.7 Hz, both pronounced on the X-axis for the sensor near LAB1O1, but less so for the sensor near LAB1P2.

The overlays on page 22 through page 24 show that the closest match between SAMS and MME measurements come when comparing the SAMS sensor head in the Columbus module to each of the 3 MME units on the JEF. The exception comes from the X-axis data for MME Unit #3, which appears as corrupt or unusable on page 24.

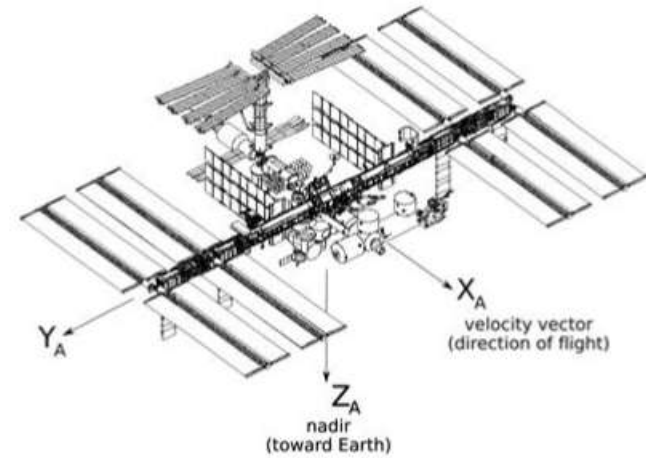
Location/Orientation of 3 JAXA MME Units Relative to SSA

LOCATIONS

MME Roughly location



ORIENTATIONS

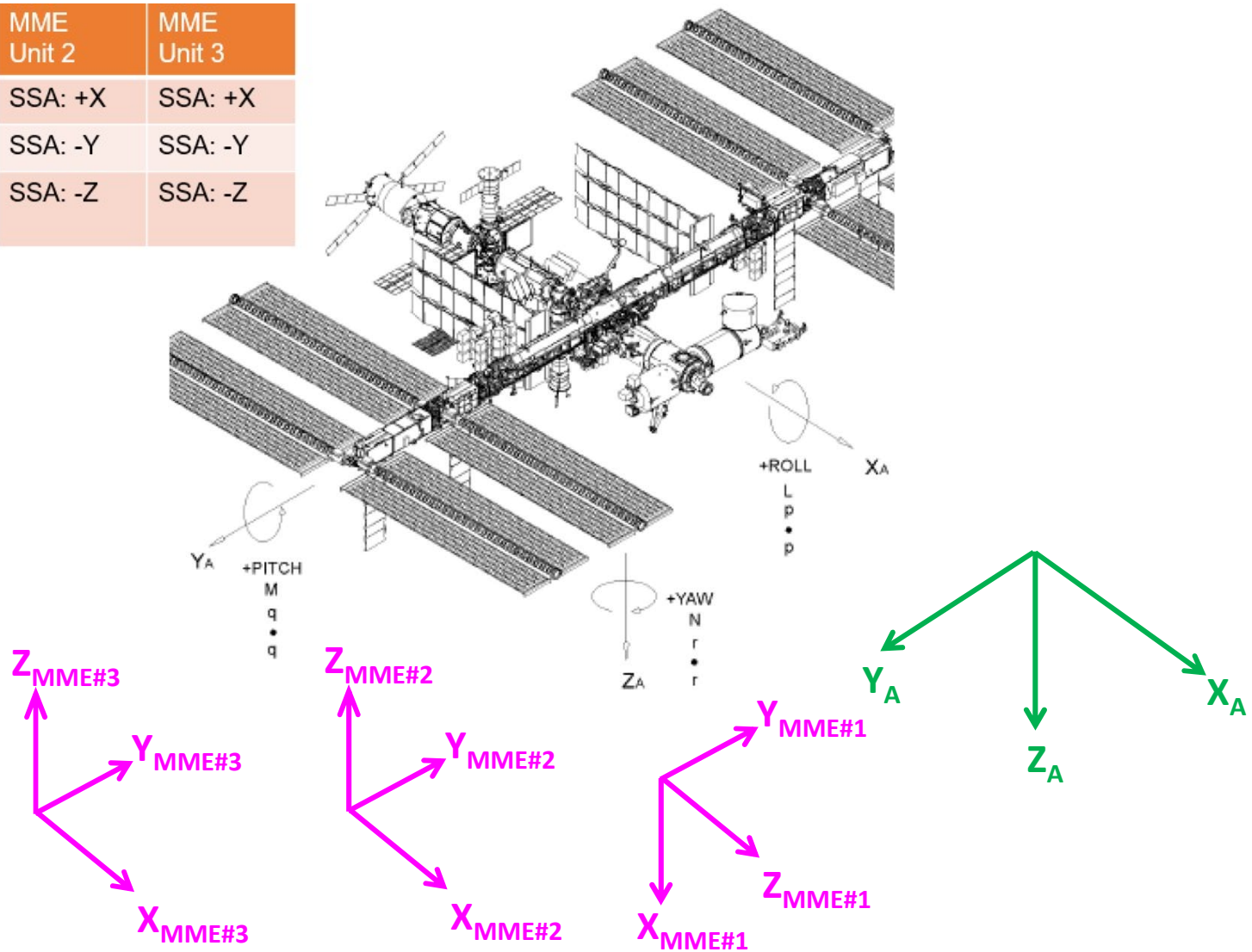


MME axis orientation

axis	MME Unit 1	MME Unit 2	MME Unit 3
+X	SSA: +Z	SSA: +X	SSA: +X
+Y	SSA: -Y	SSA: -Y	SSA: -Y
+Z	SSA: +X	SSA: -Z	SSA: -Z

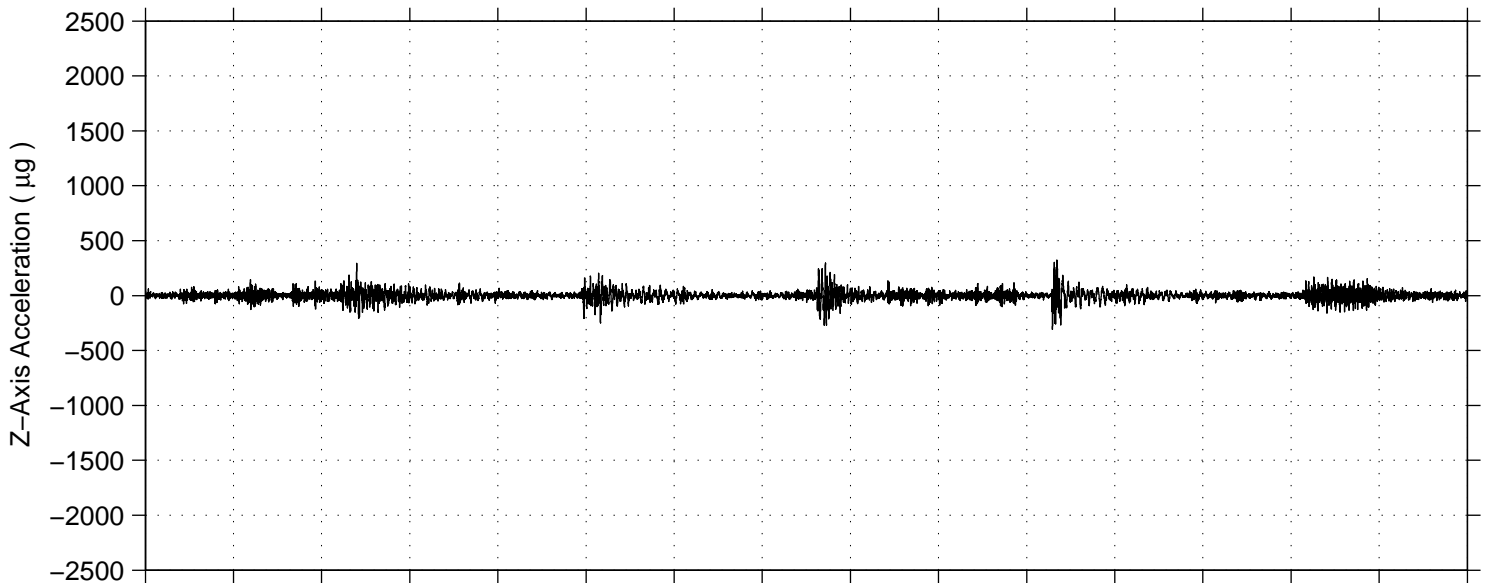
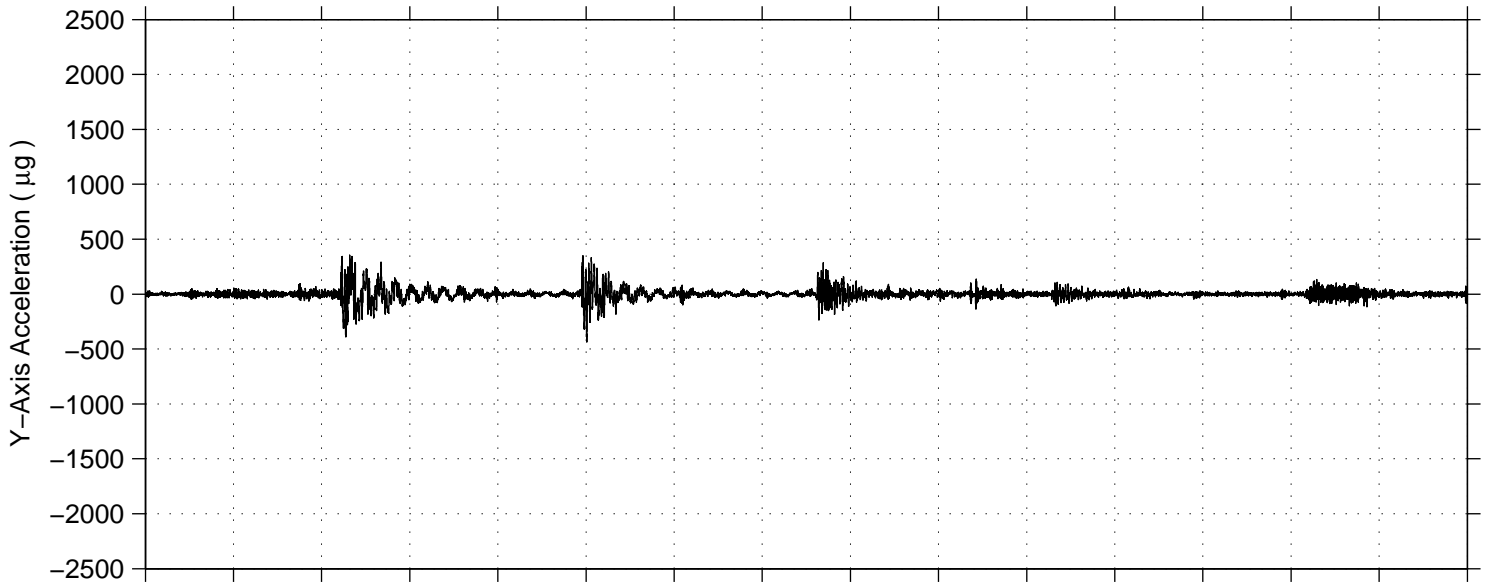
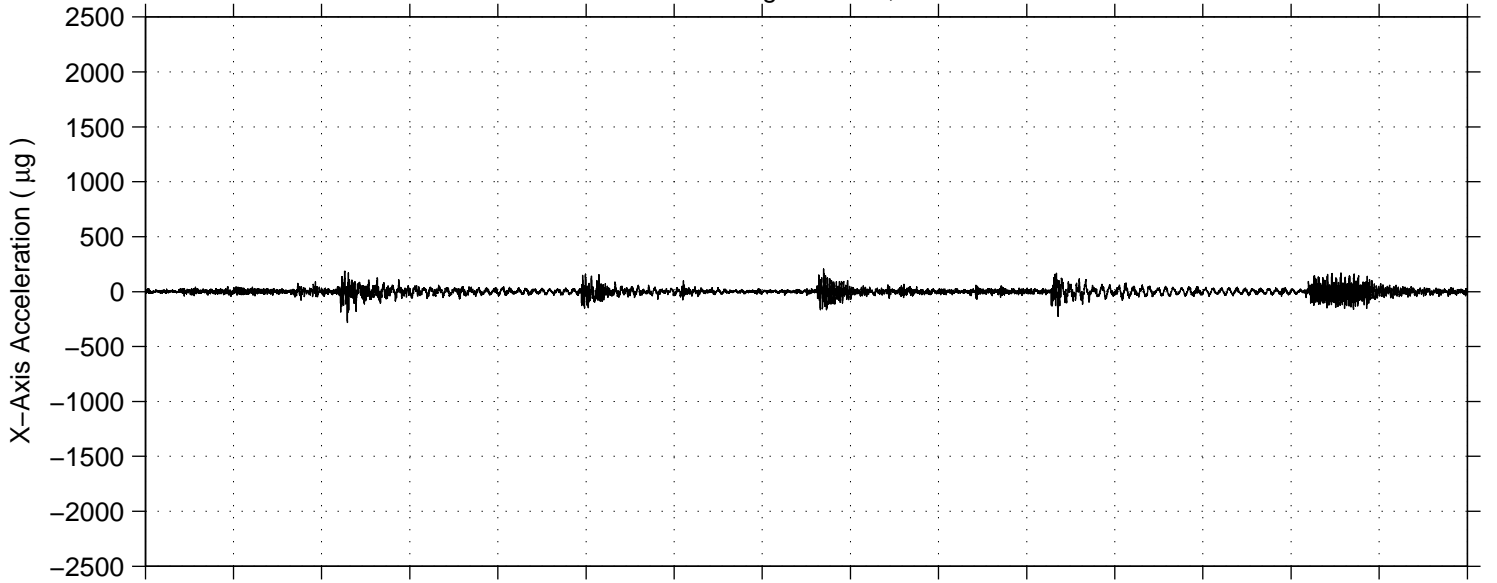
Relative Orientation of SAMS Sensor for SSA Transformation

axis	MME Unit 1	MME Unit 2	MME Unit 3
+X	SSA: +Z	SSA: +X	SSA: +X
+Y	SSA: -Y	SSA: -Y	SSA: -Y
+Z	SSA: +X	SSA: -Z	SSA: -Z



Start-Stop GMT	Attitude	Ref. Frame	YPR	F/T Cfg.	Event	Remarks
						08/16/2018
228/12:58:55	+XVV	LVLH	356	MMT	Free Drift for Dedicated Thruster Firing (DTF) Test	Reference chit 16417 for more details
—	+ZLV		358	FDO		
			0.7			
228/13:01:55	+XVV	LVLH	356	FDO	Thruster Firing Test 1	
228/13:01:56	+ZLV		358	FDO		
			0.7			
228/13:01:56	+XVV	LVLH	356	FDO	Free Drift for DTF Test	
228/13:01:59	+ZLV		358	FDO		
			0.7			
228/13:01:59	+XVV	LVLH	356	FDO	Thruster Firing Test 2	
228/13:02:00	+ZLV		358	FDO		
			0.7			
228/13:02:00	+XVV	LVLH	356	FDO	Free Drift for DTF Test	
228/13:04:39	+ZLV		358	FDO		
			0.7			
228/13:04:39	+XVV	LVLH	356	FDO	Thruster Firing Test 3	
228/13:04:40	+ZLV		358	FDO		
			0.7			
228/13:04:40	+XVV	LVLH	356	FDO	Free Drift for DTF Test	
228/13:07:19	+ZLV		358	FDO		
			0.7			
228/13:07:19	+XVV	LVLH	356	FDO	Thruster Firing Test 4	
228/13:07:20	+ZLV		358	FDO		
			0.7			
228/13:07:20	+XVV	LVLH	356	FDO	Free Drift for DTF Test	
228/13:09:59	+ZLV		358	FDO		
			0.7			
228/13:09:59	+XVV	LVLH	356	FDO	Thruster Firing Test 5	
228/13:10:00	+ZLV		358	FDO		
			0.7			
228/13:10:00	+XVV	LVLH	356	FDO	Free Drift for DTF Test	
228/13:12:39	+ZLV		358	FDO		
			0.7			
228/13:12:39	+XVV	LVLH	356	FDO	RS Snap and Hold	RS Recovery from Free Drift
—	+ZLV		358	THR		
			0.7			
228/13:12:40	+XVV	LVLH	356	THR	Mnvr to LVLH TEA	
228/13:17:40	+ZLV		358	THR		
	TEA		0.7			
228/13:40:00	+XVV	LVLH	356	THR	Handover RS to US Momentum Management	TEA for VV#3z_N1neN2nezefe, PSARJ Auto, SSARJ Auto
—	+ZLV		358	MMT		
	TEA		0.7			

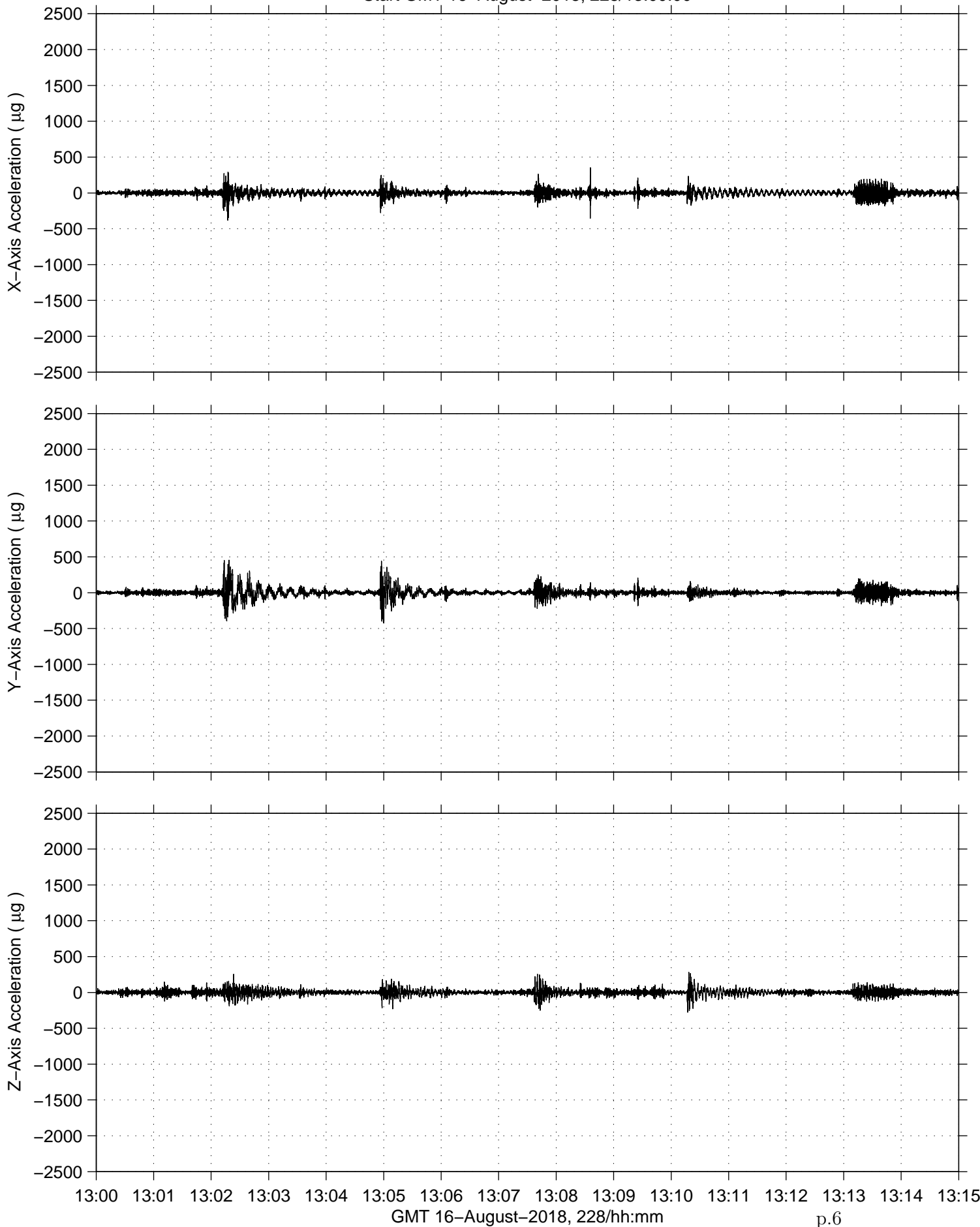
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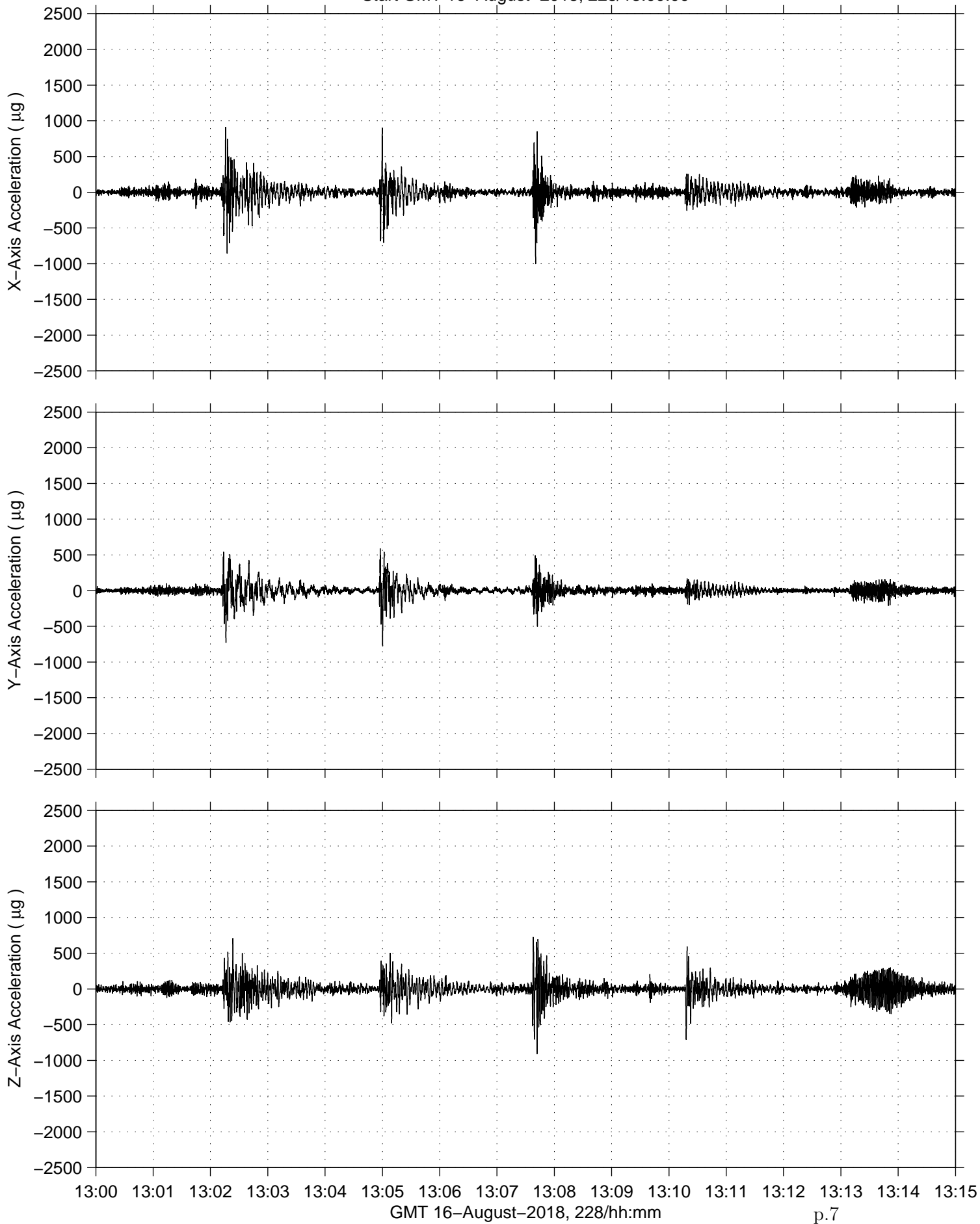
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GMT 16-August-2018, 228/hh:mm

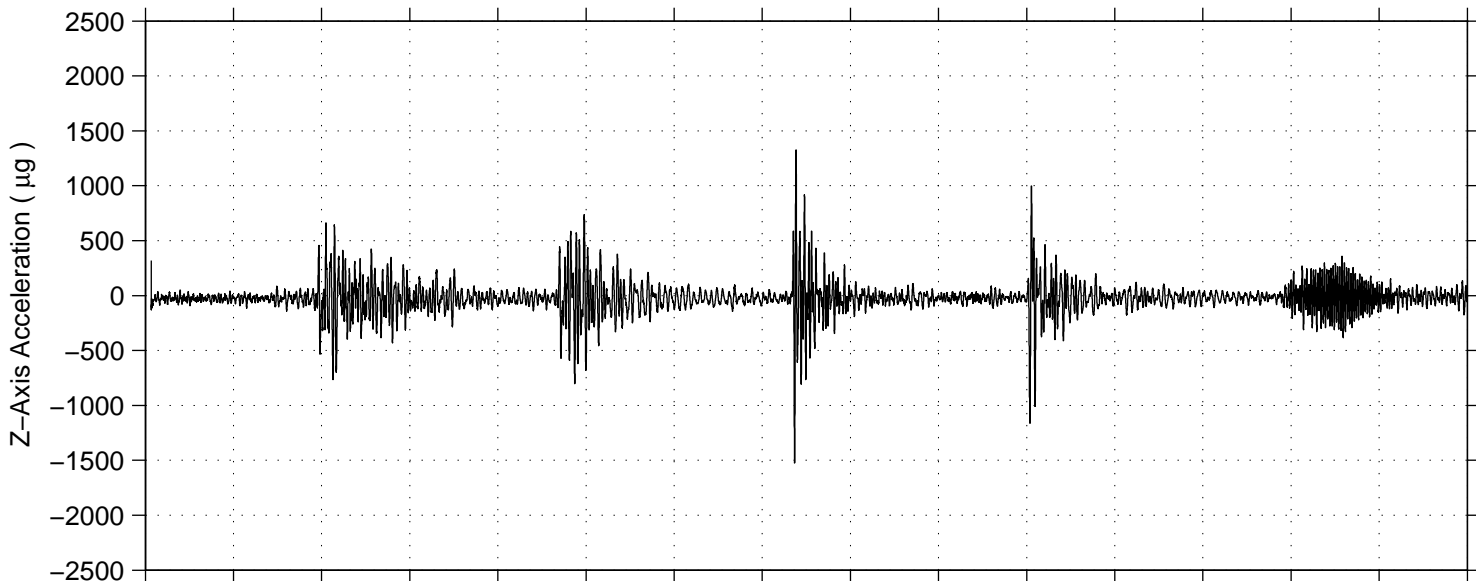
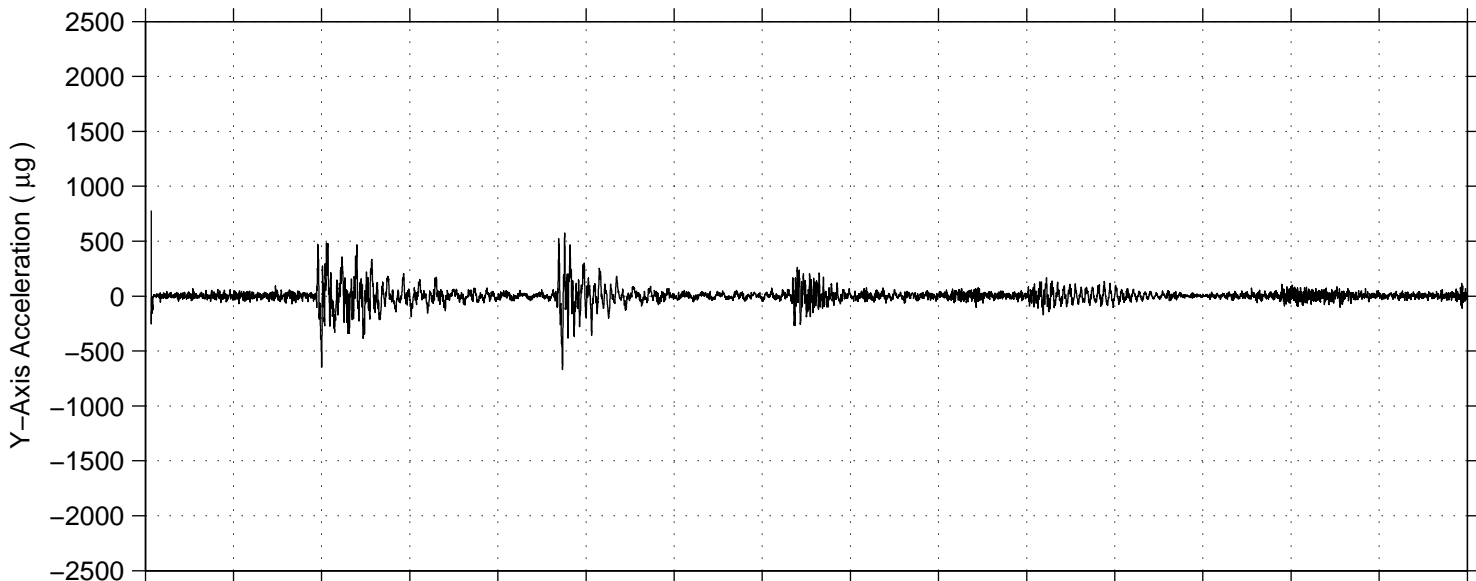
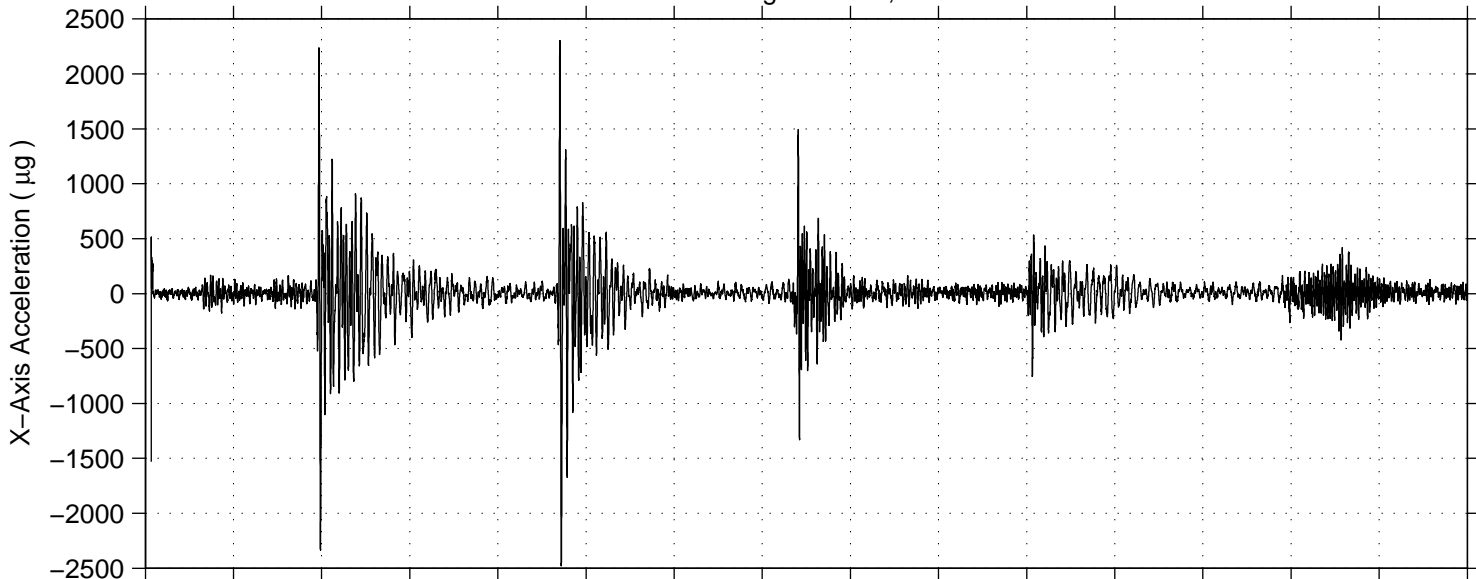
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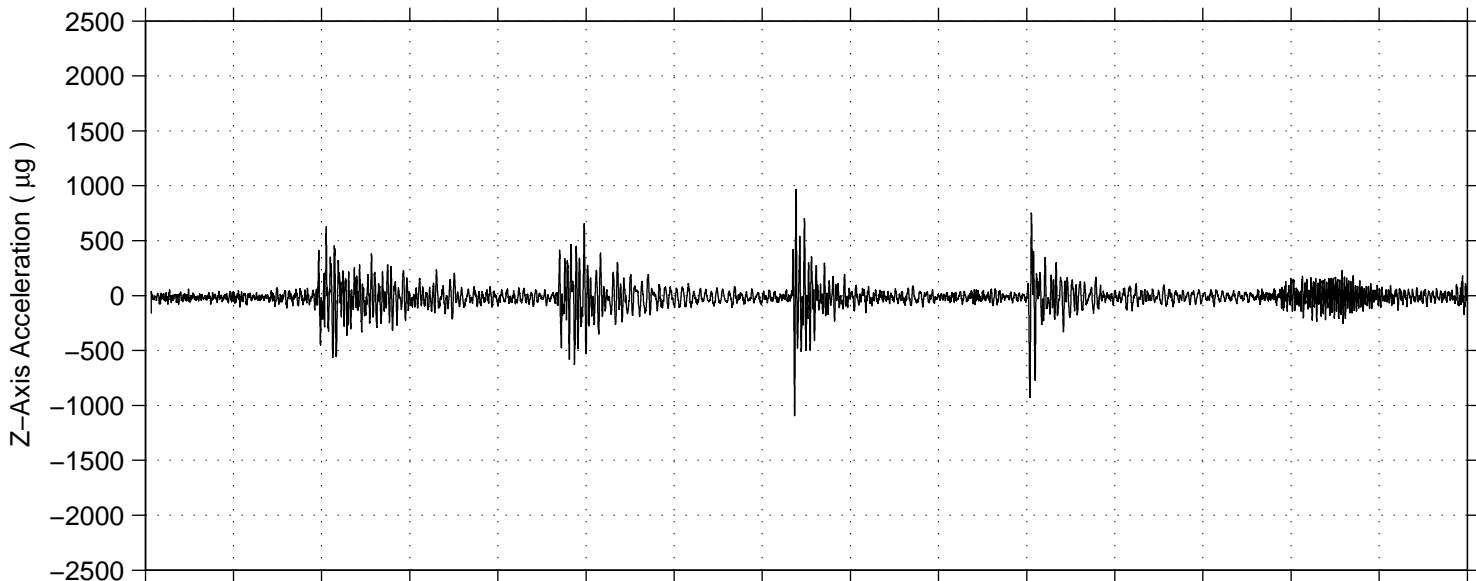
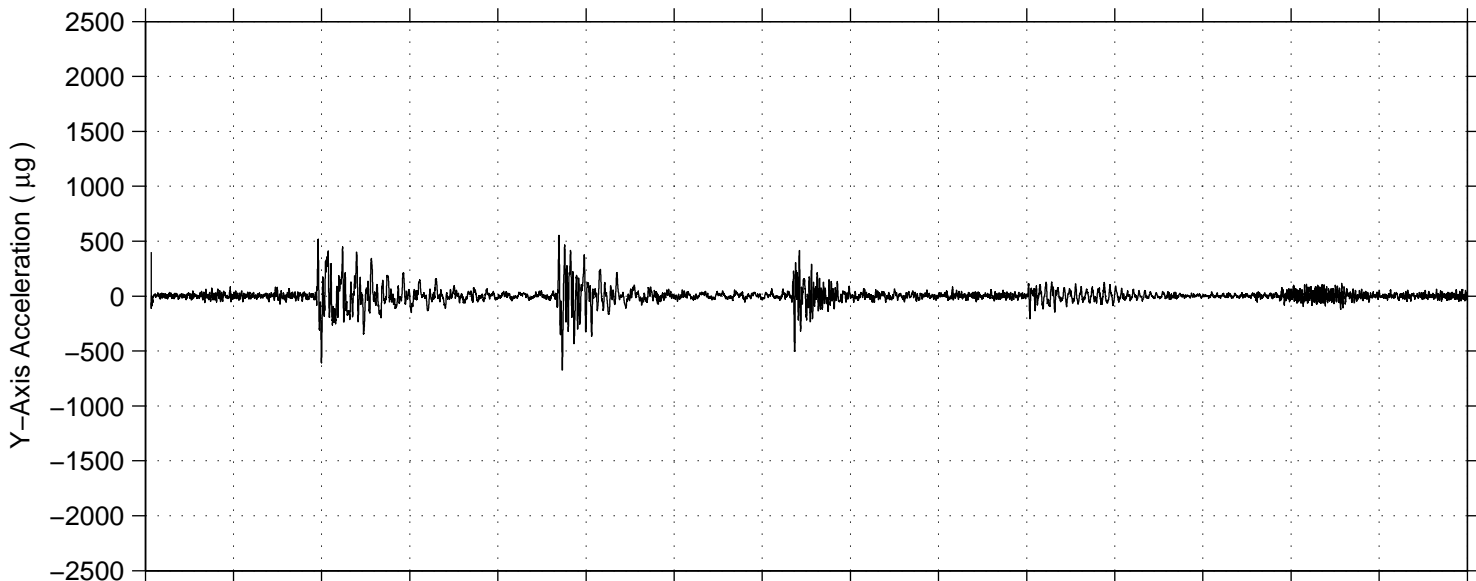
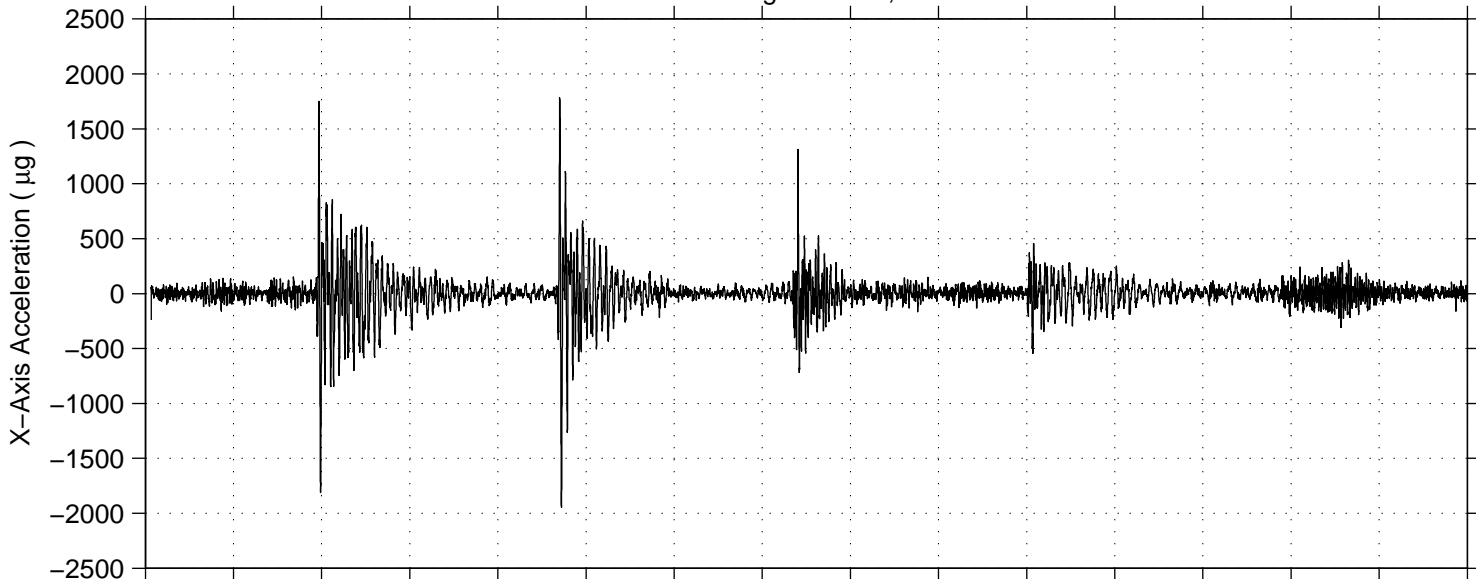
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GMT 16-August-2018, 228/hh:mm

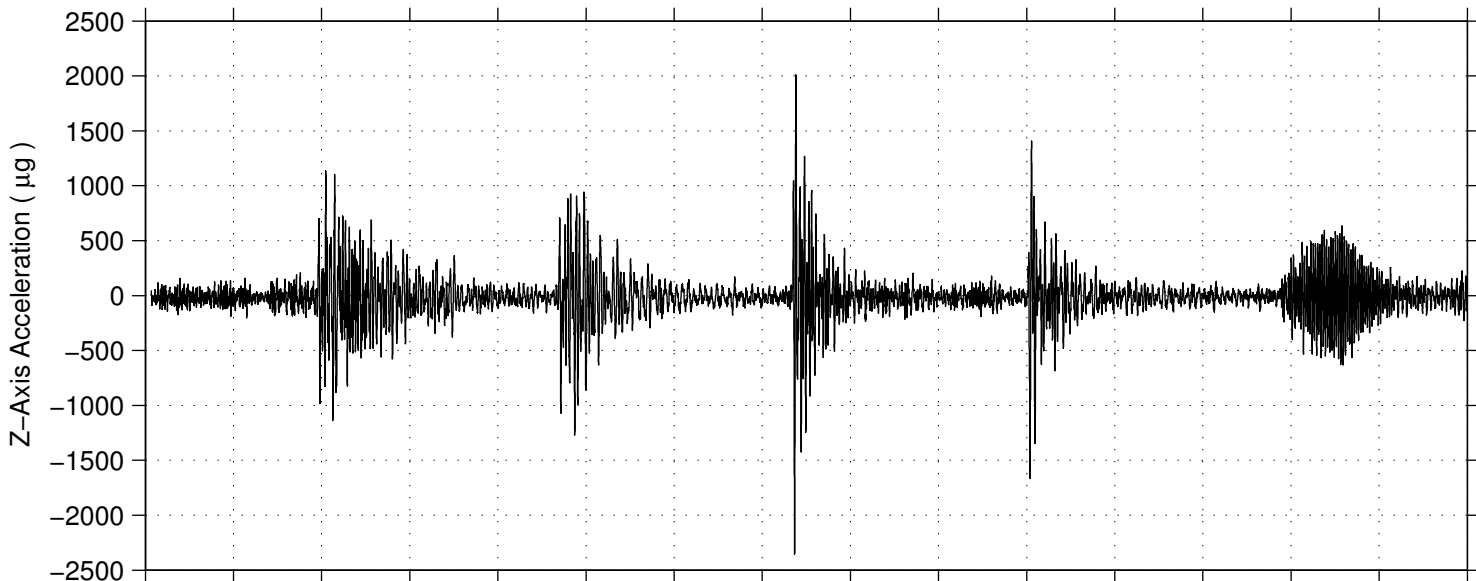
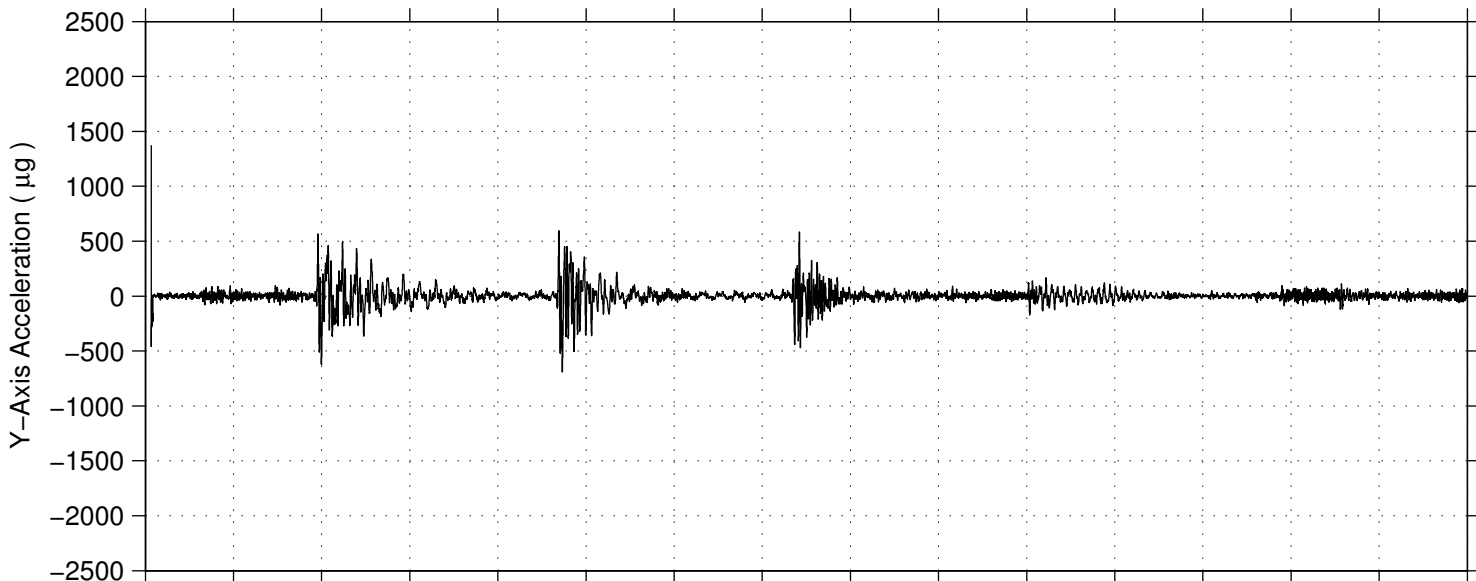
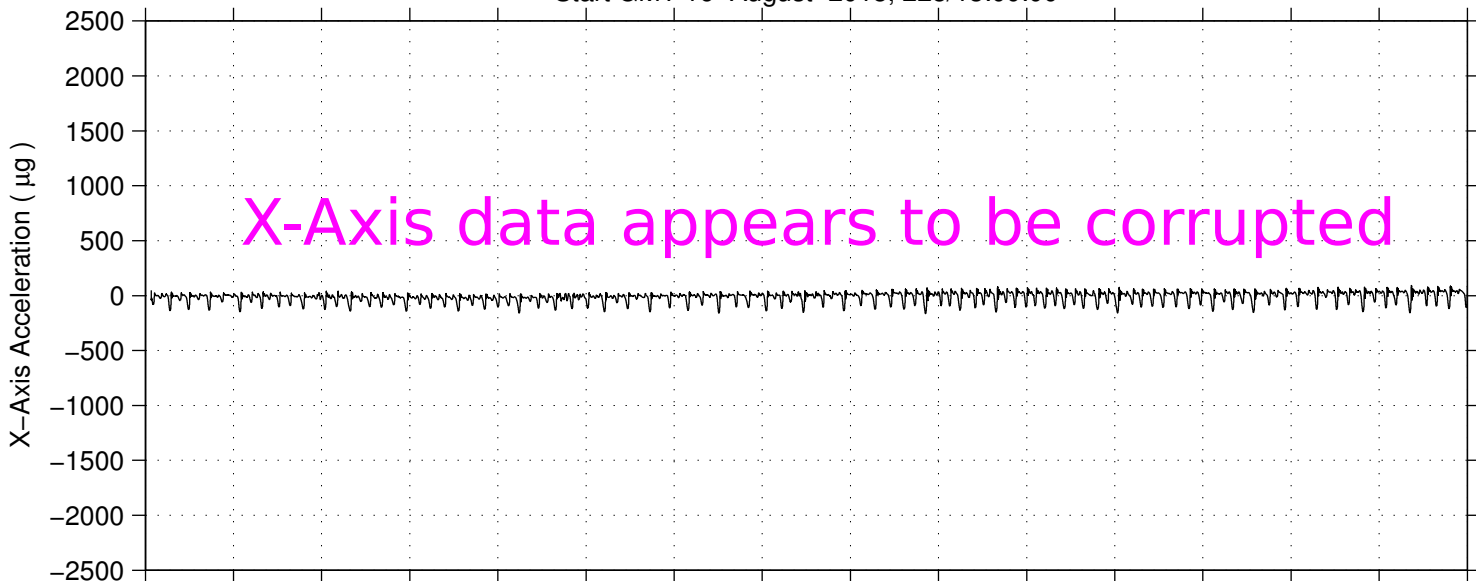
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GMT 16-August-2018, 228/hh:mm

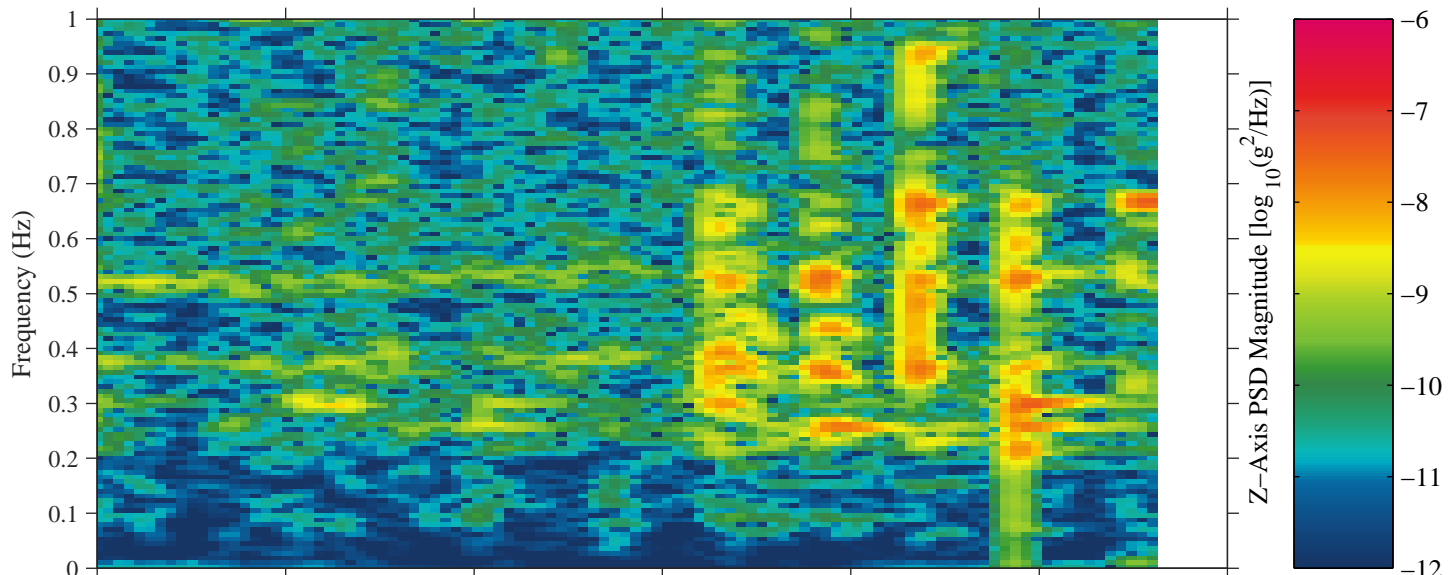
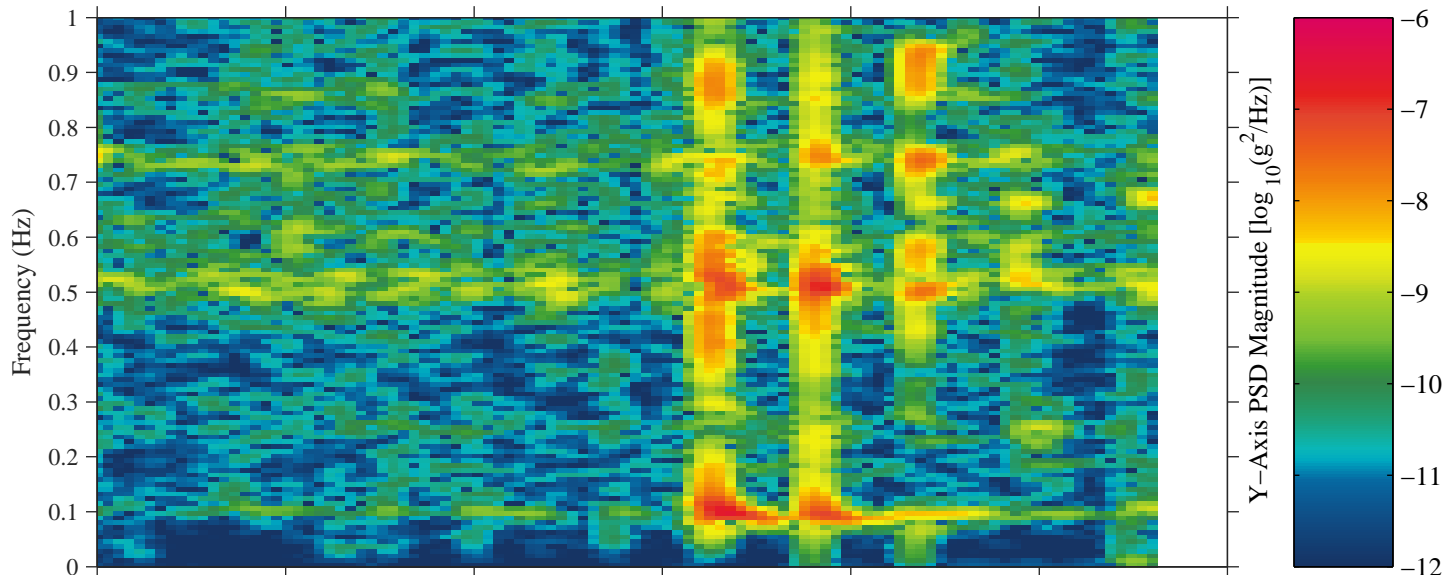
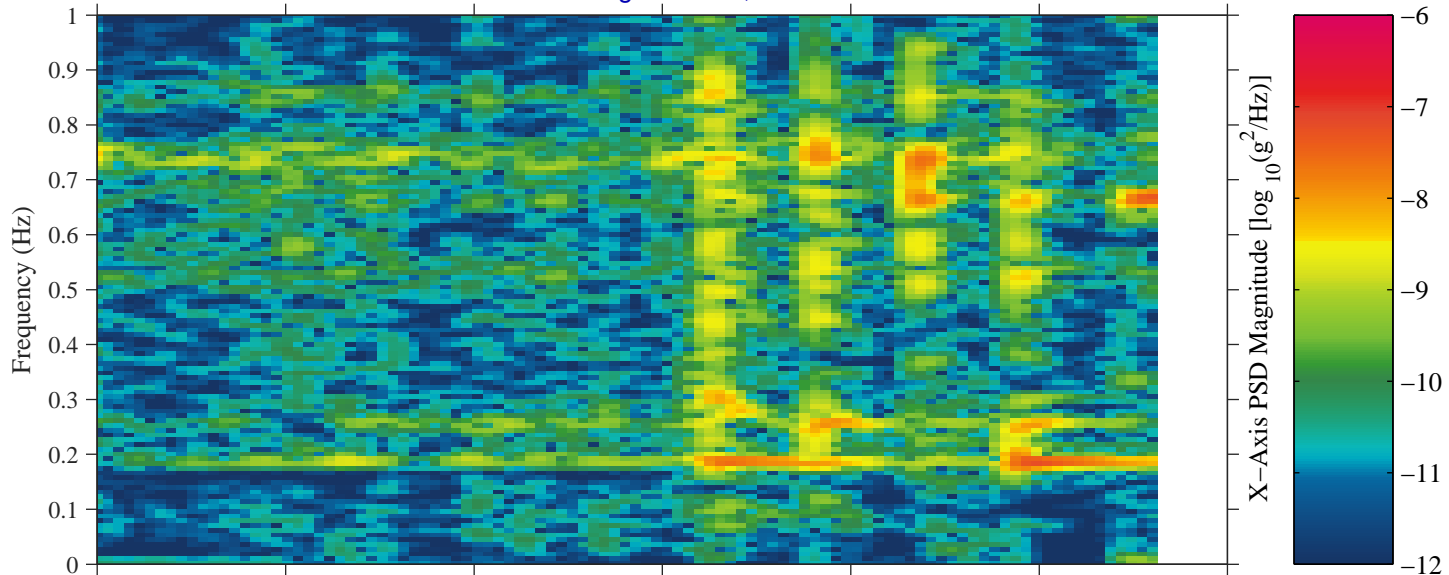
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GMT 16-August-2018, 228/hh:mm

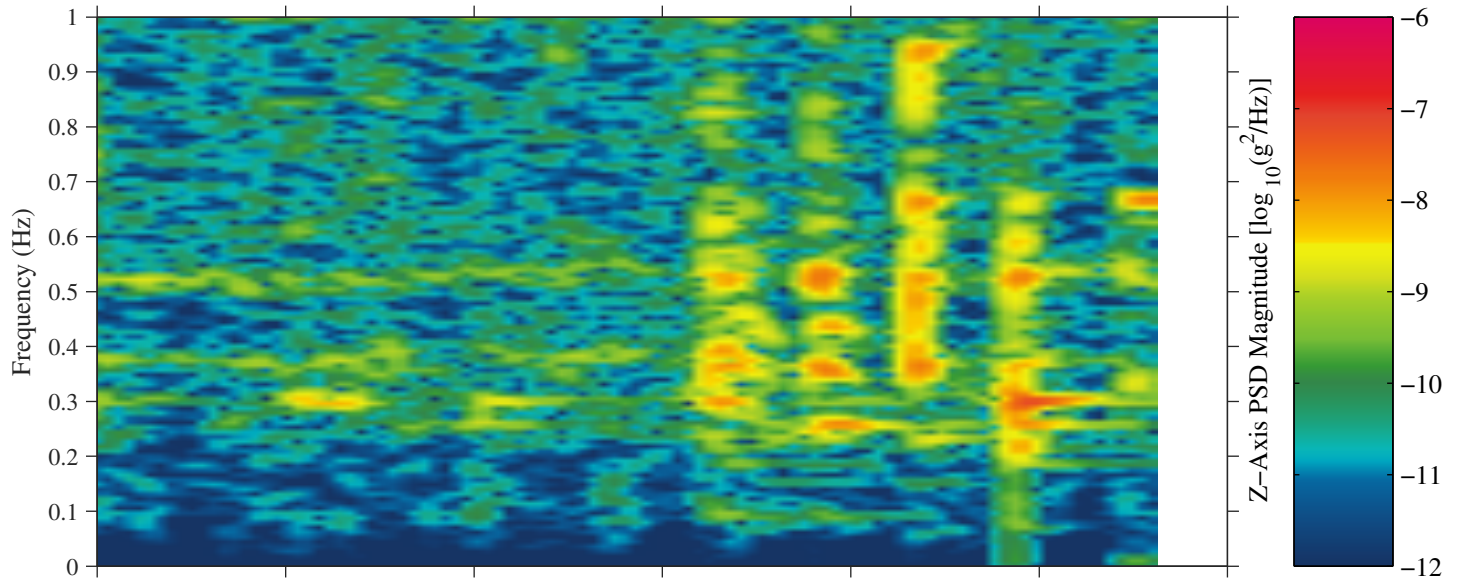
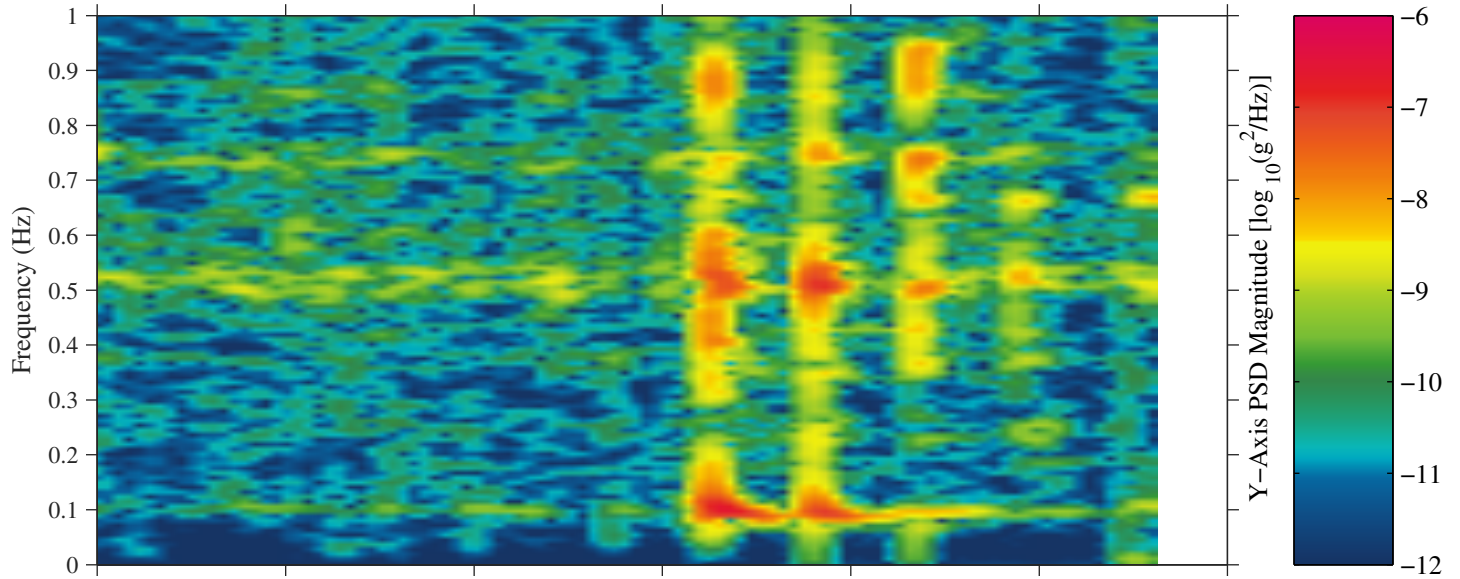
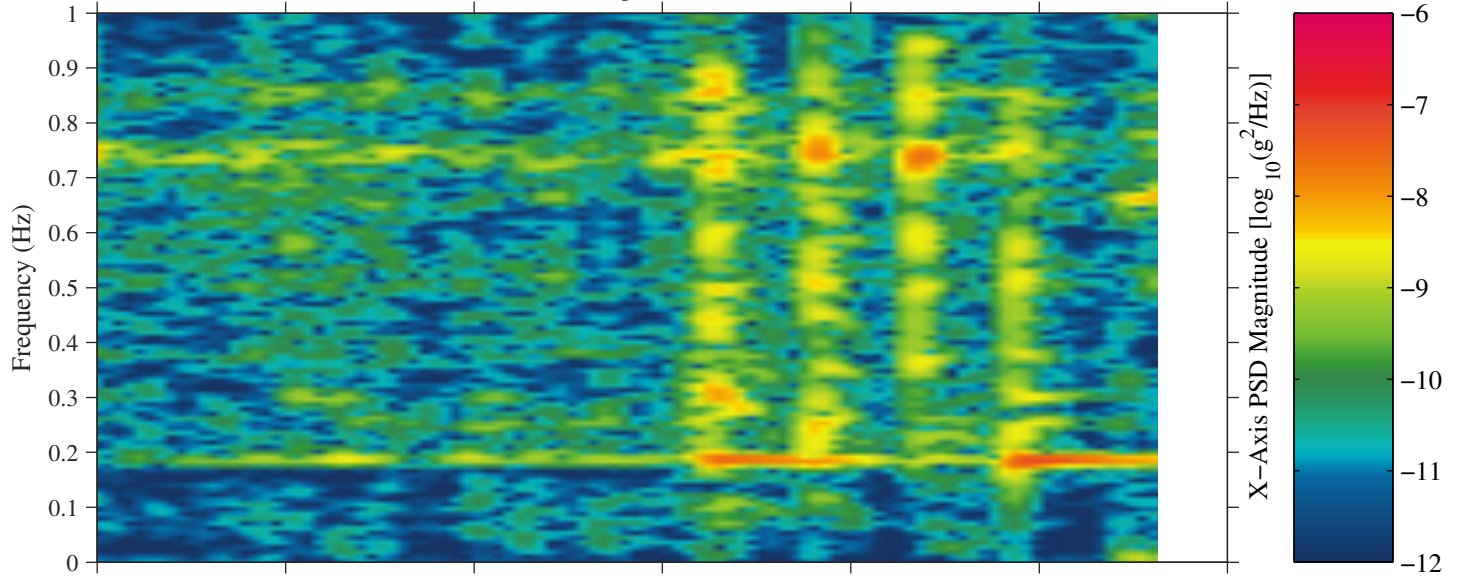
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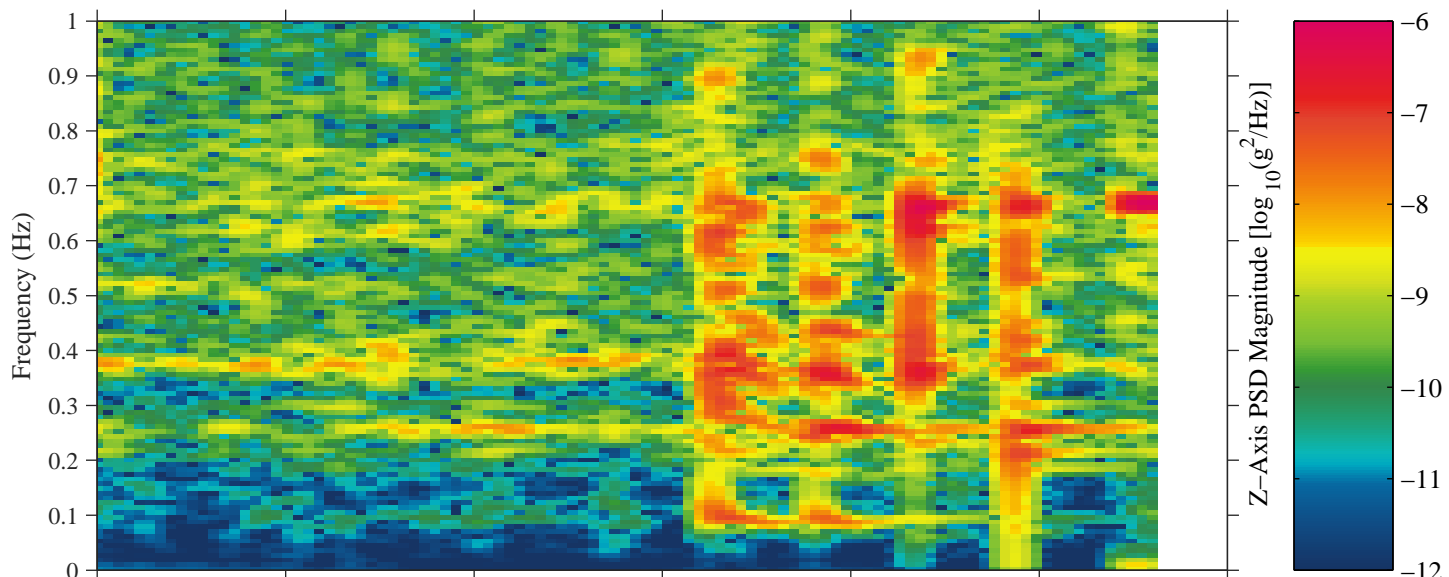
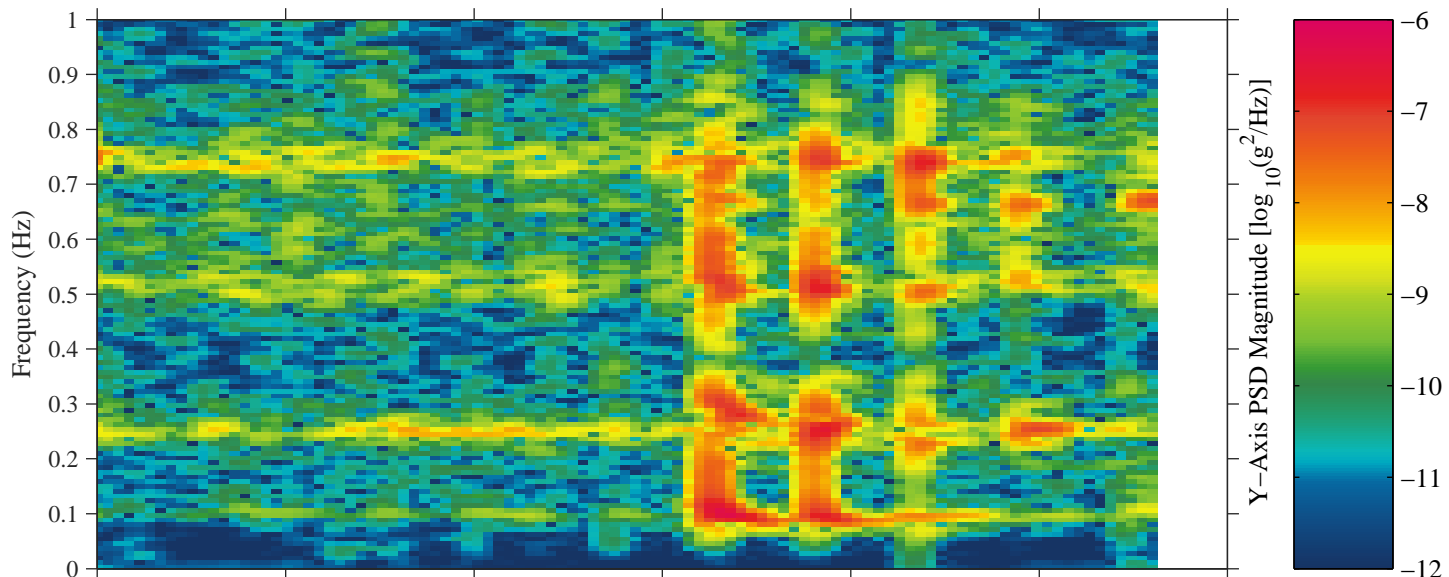
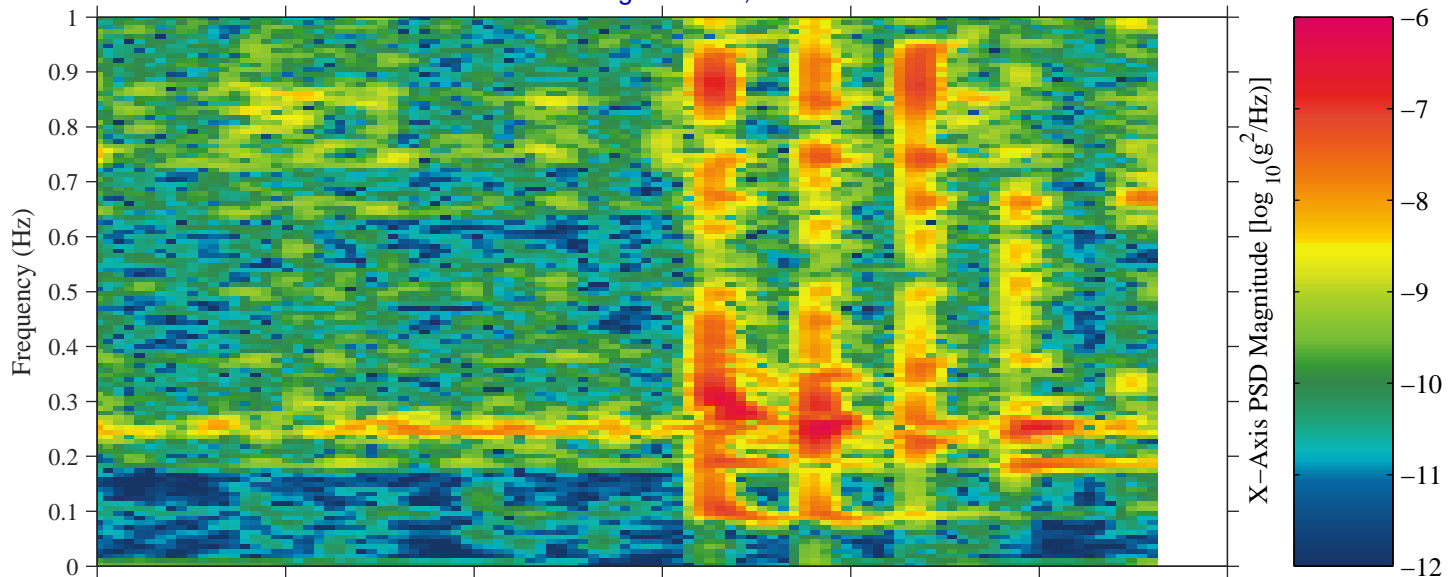
GMT 16-August-2018, 228/hh:mm

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

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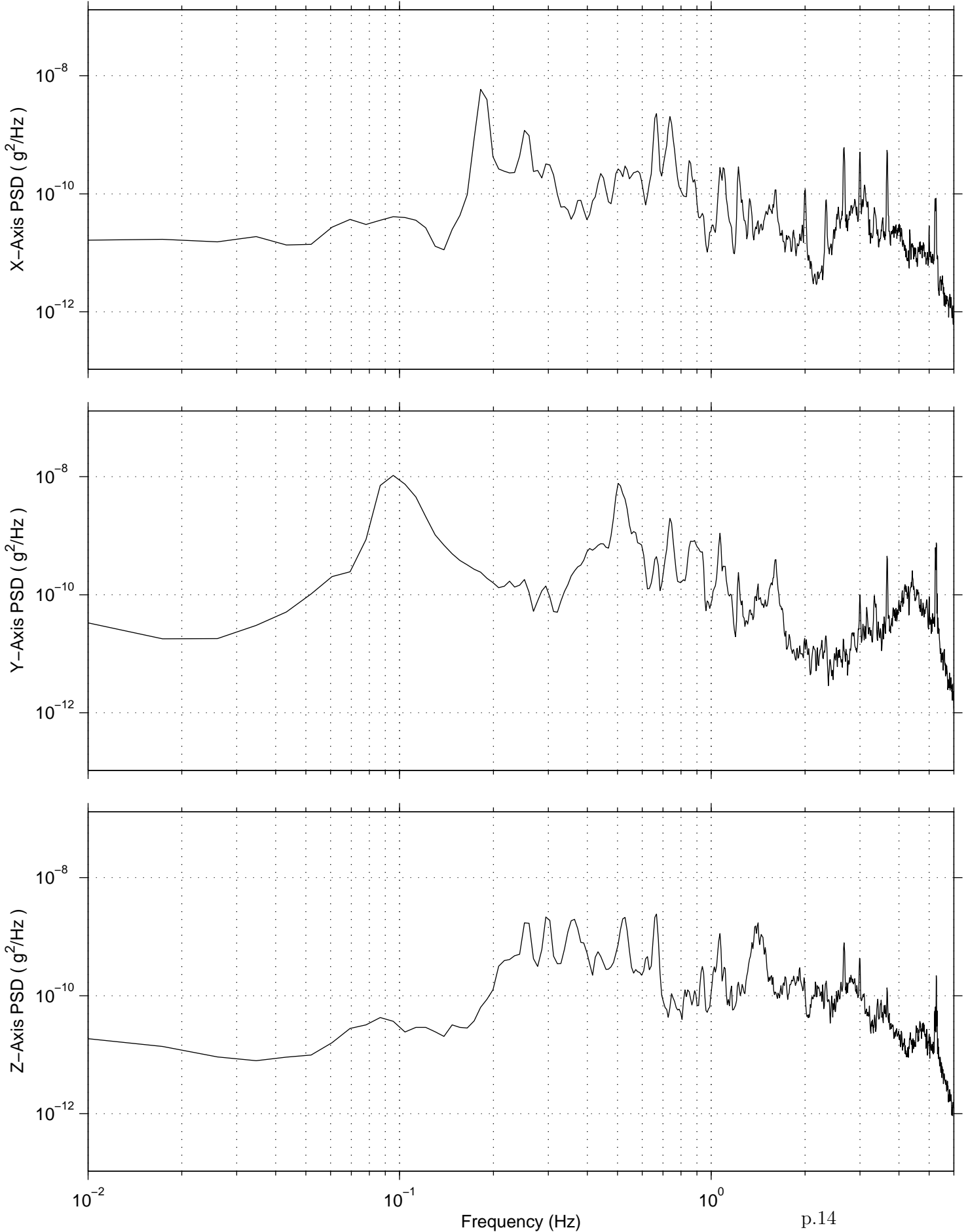


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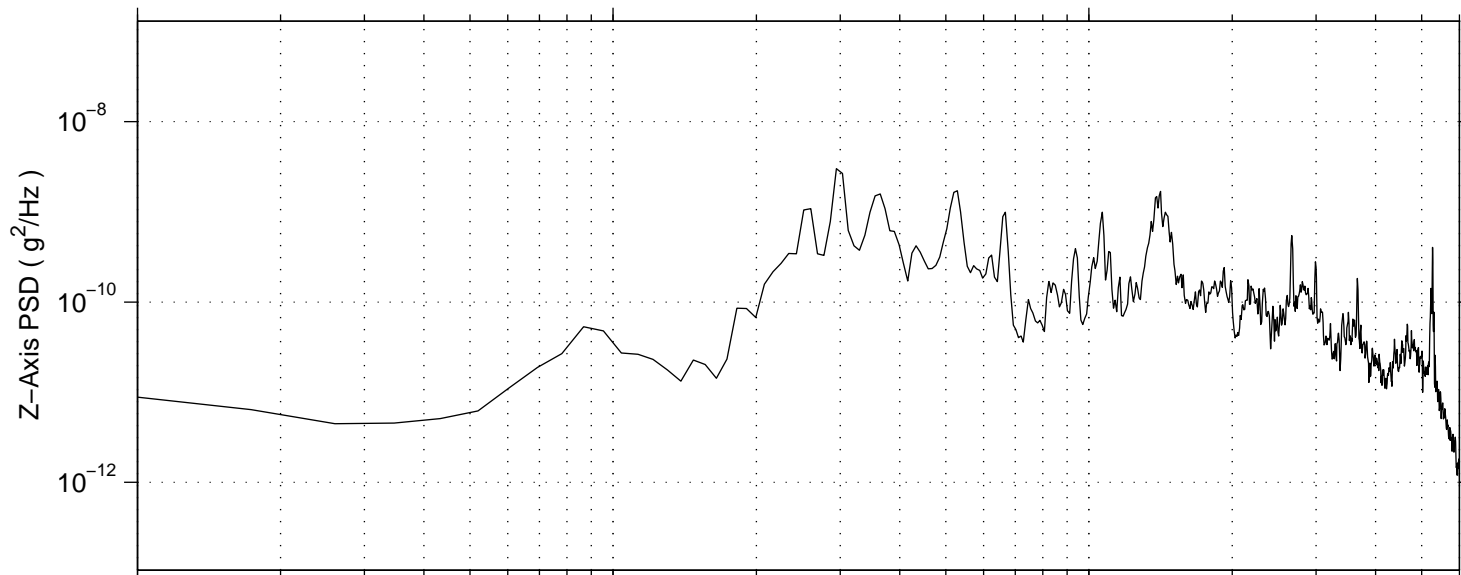
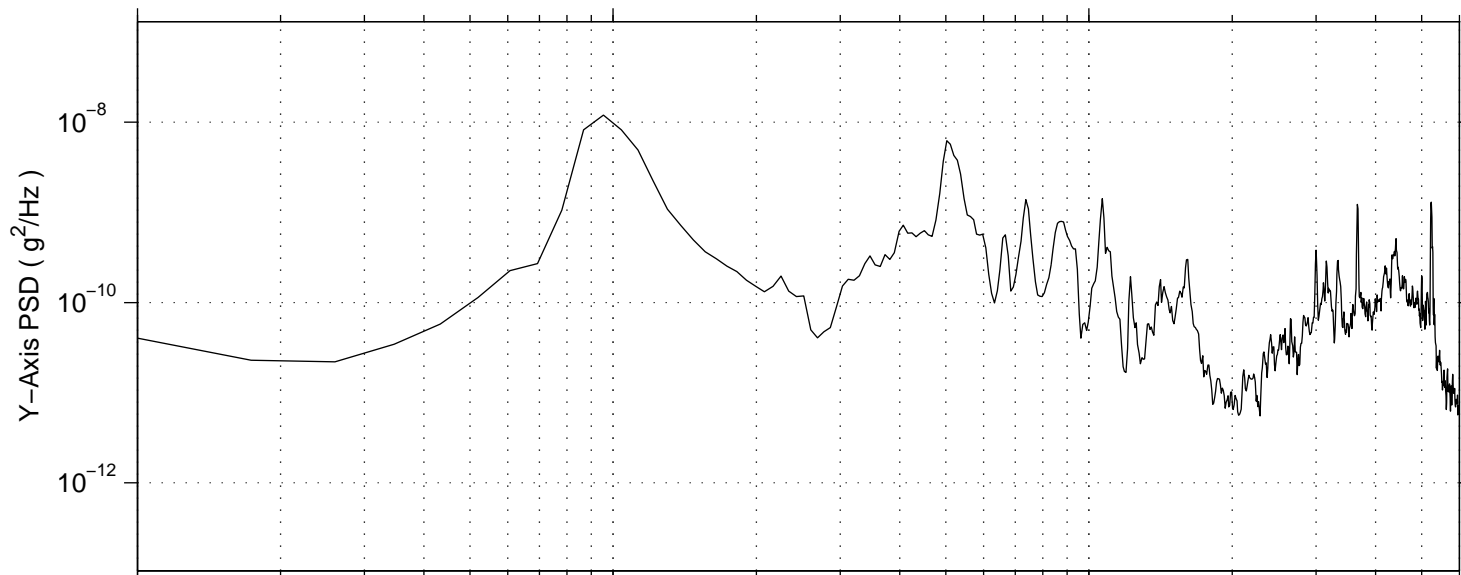
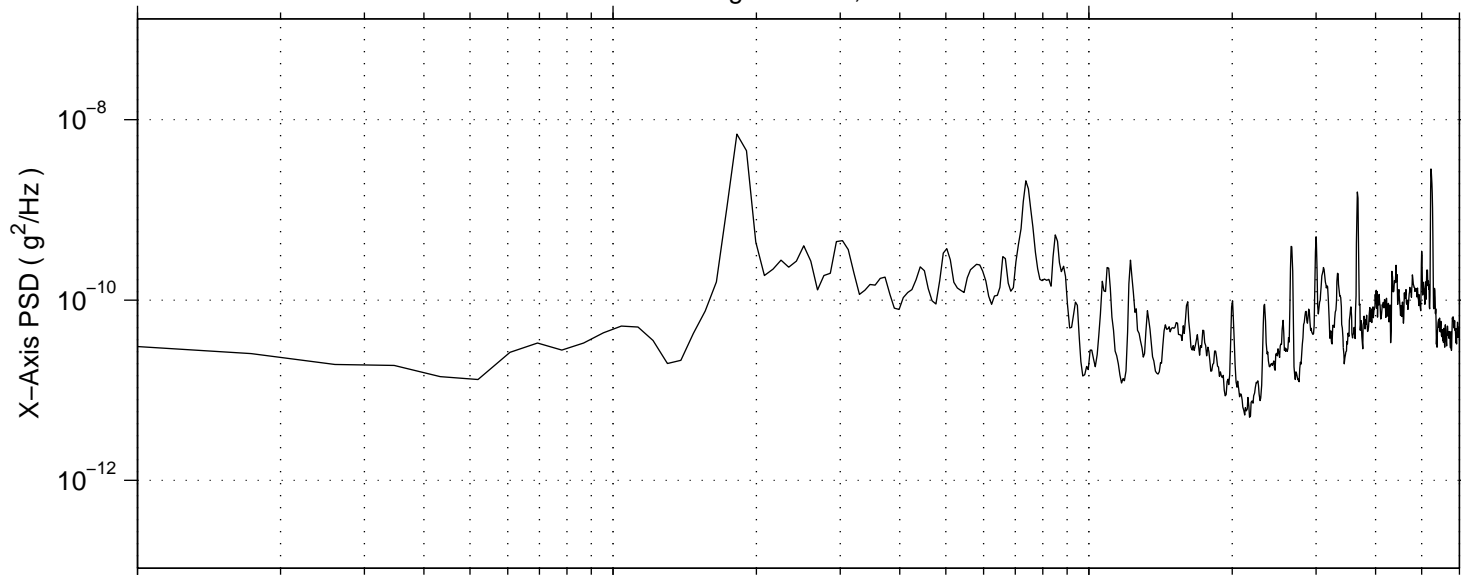


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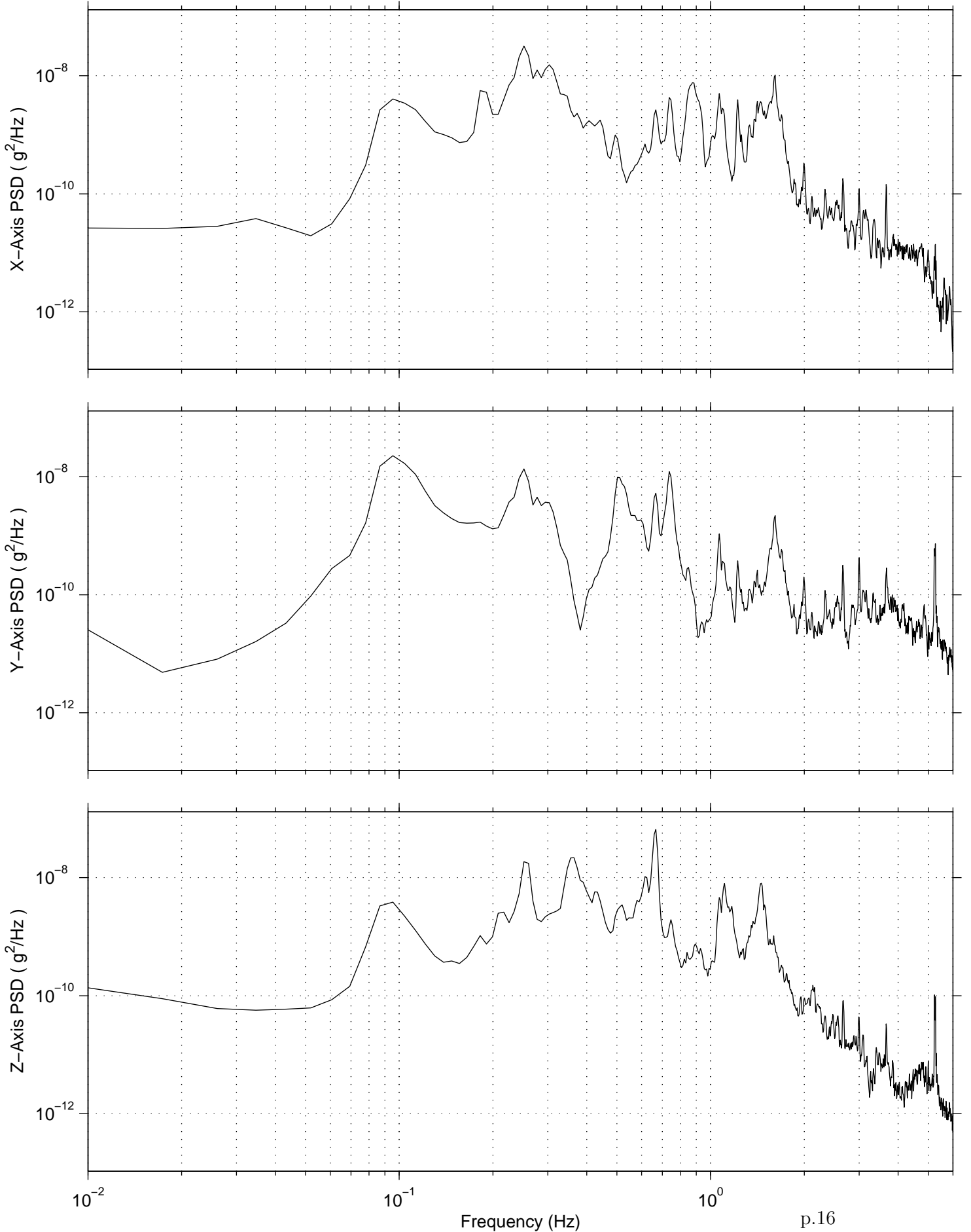
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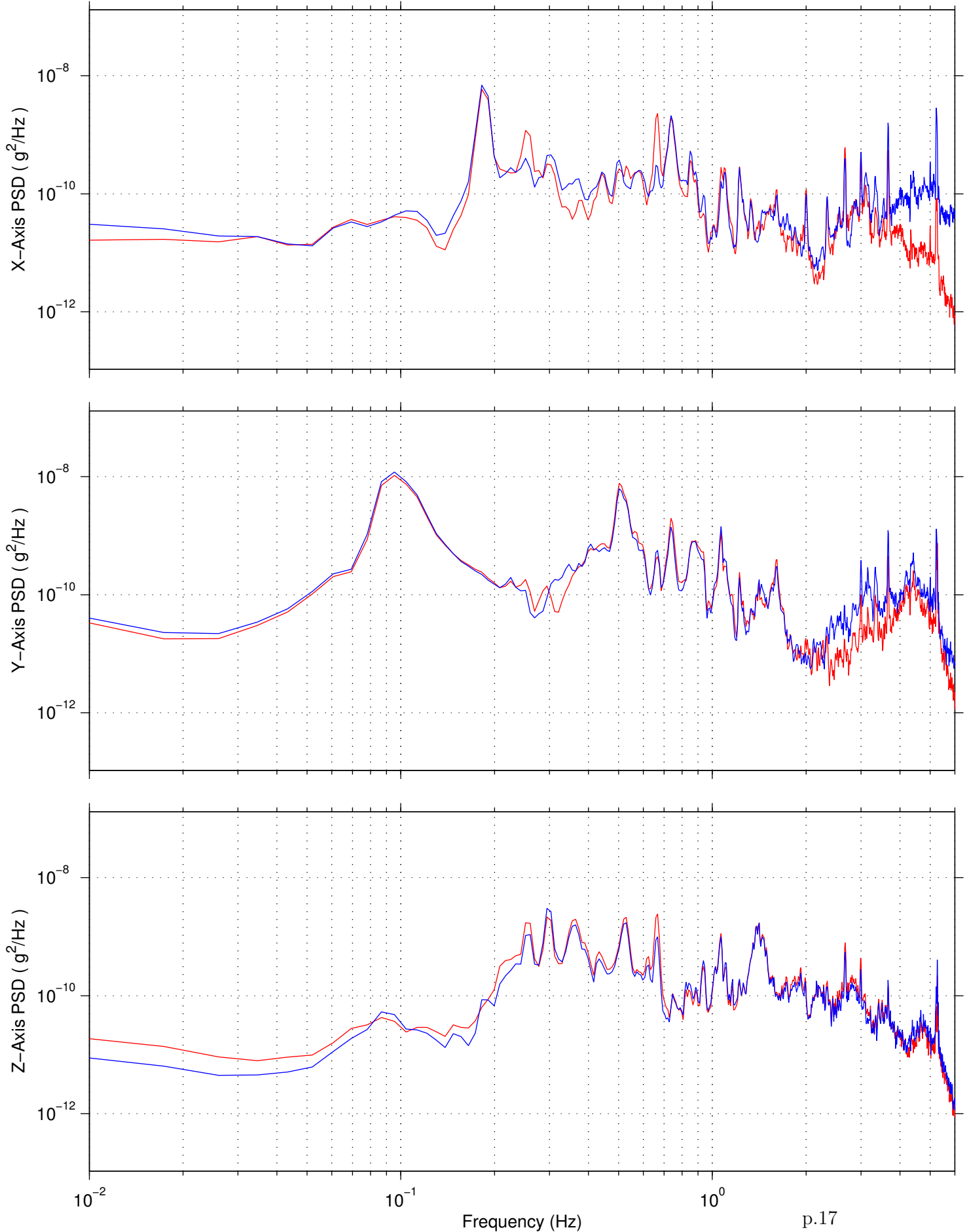
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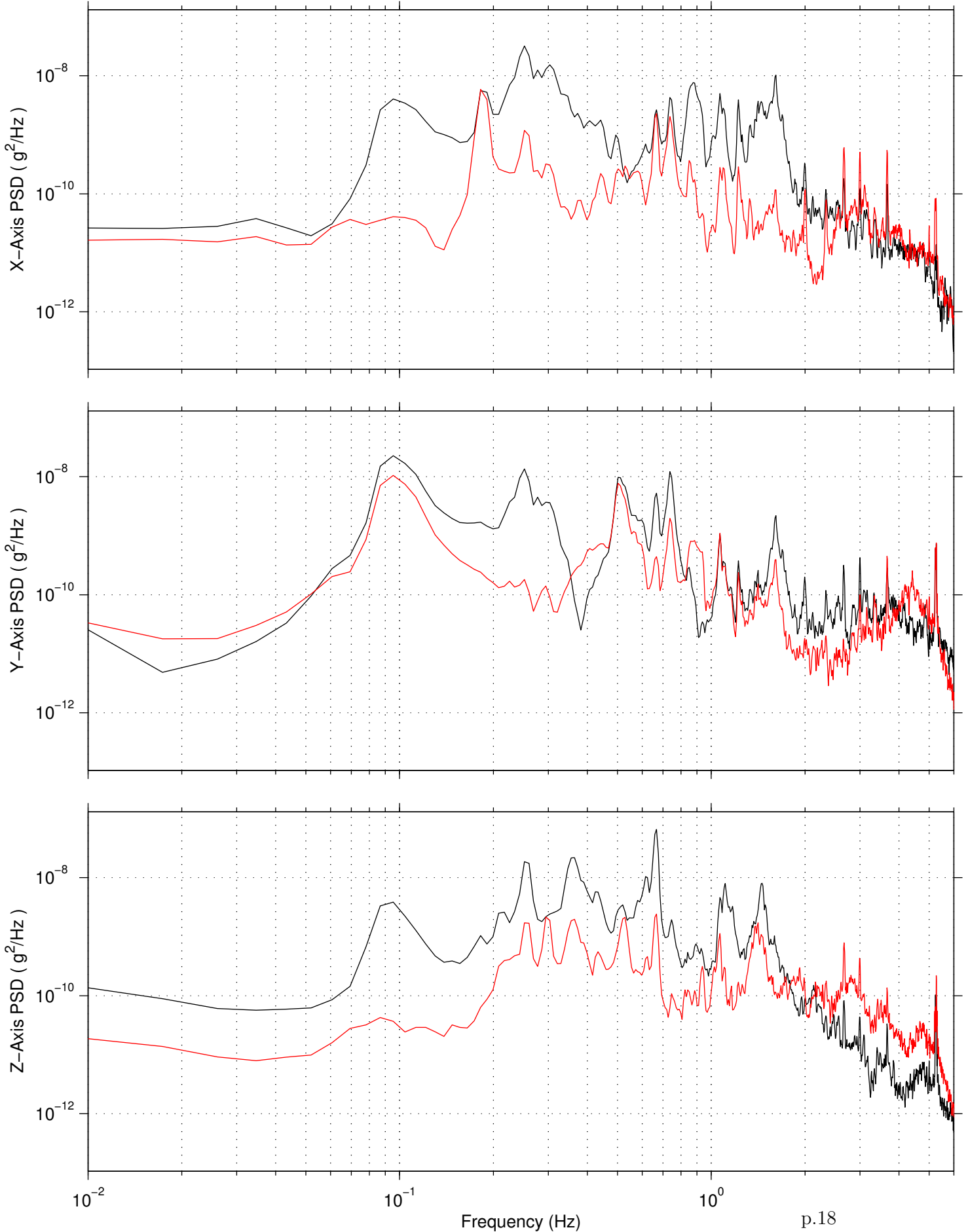
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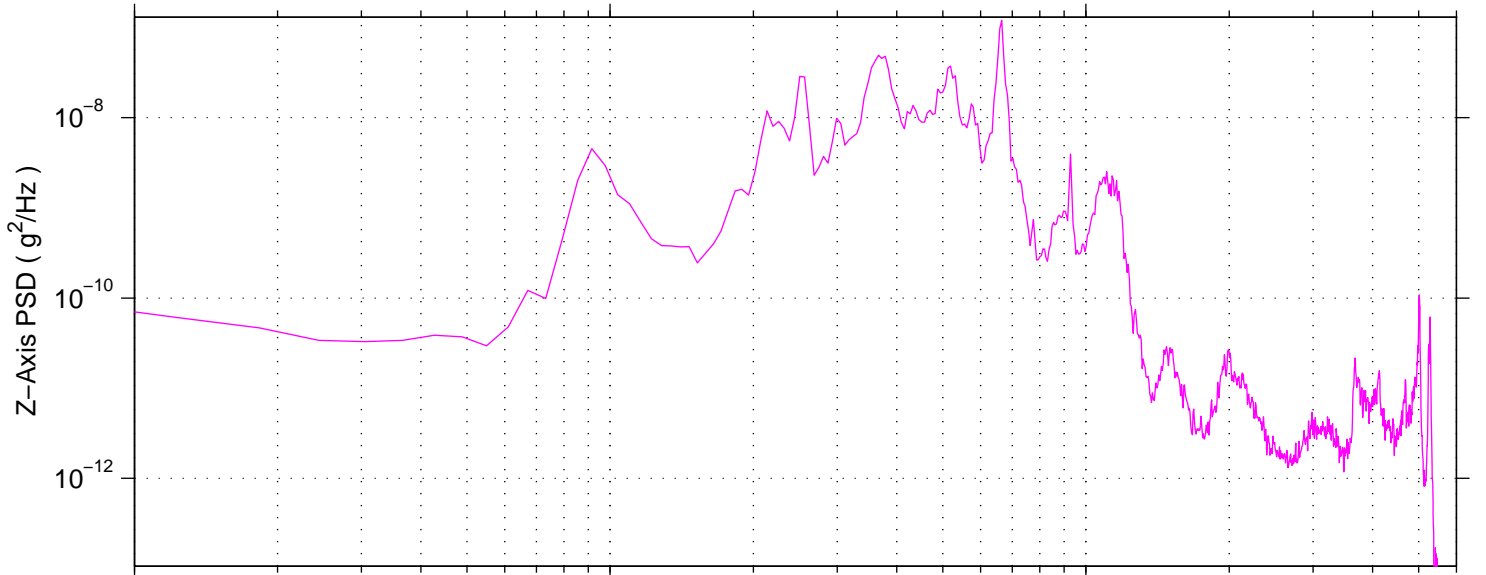
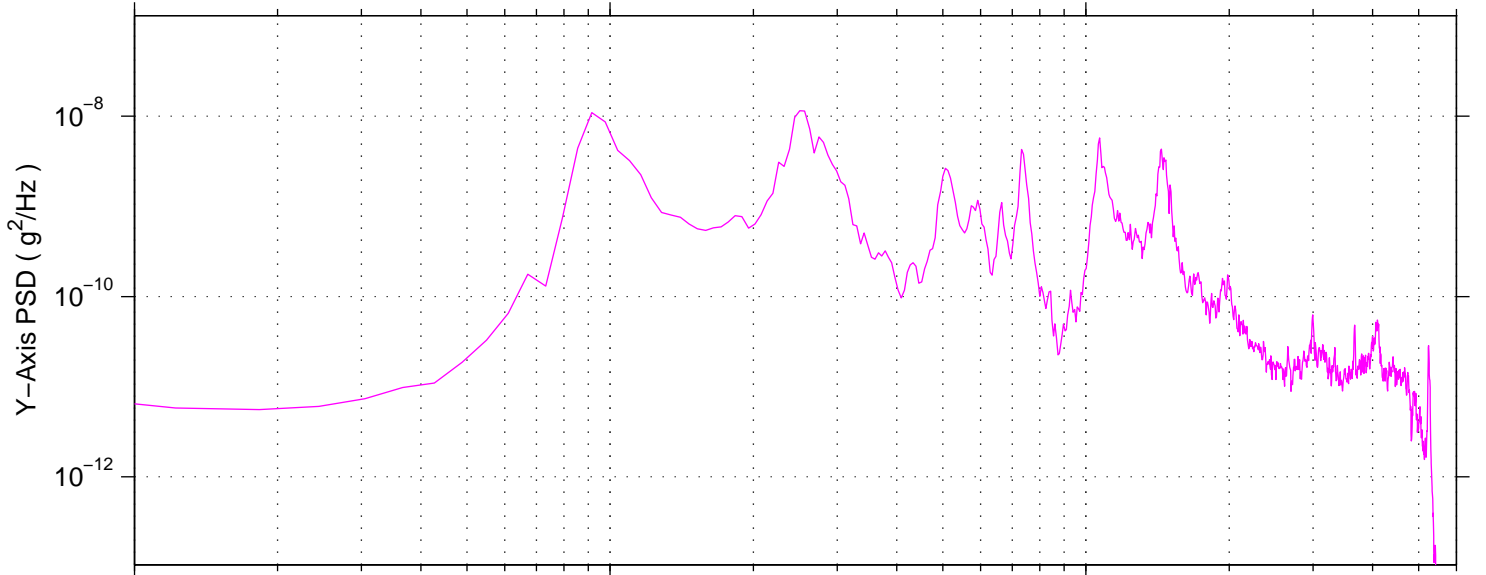
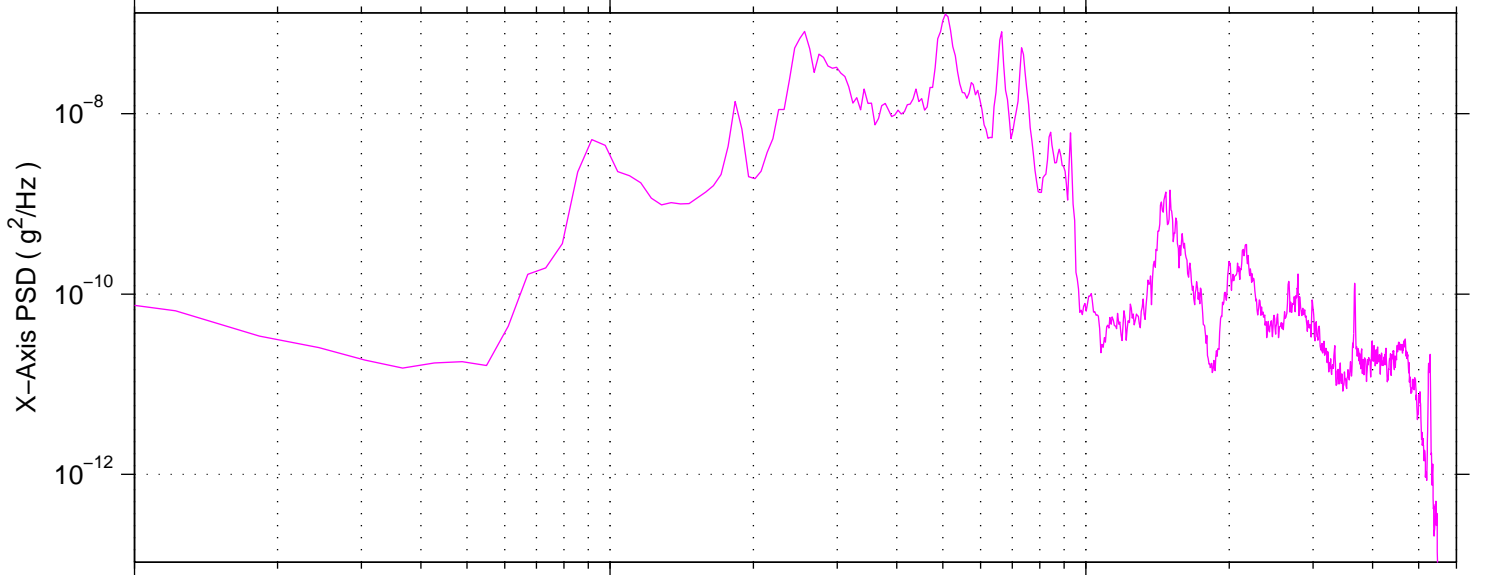
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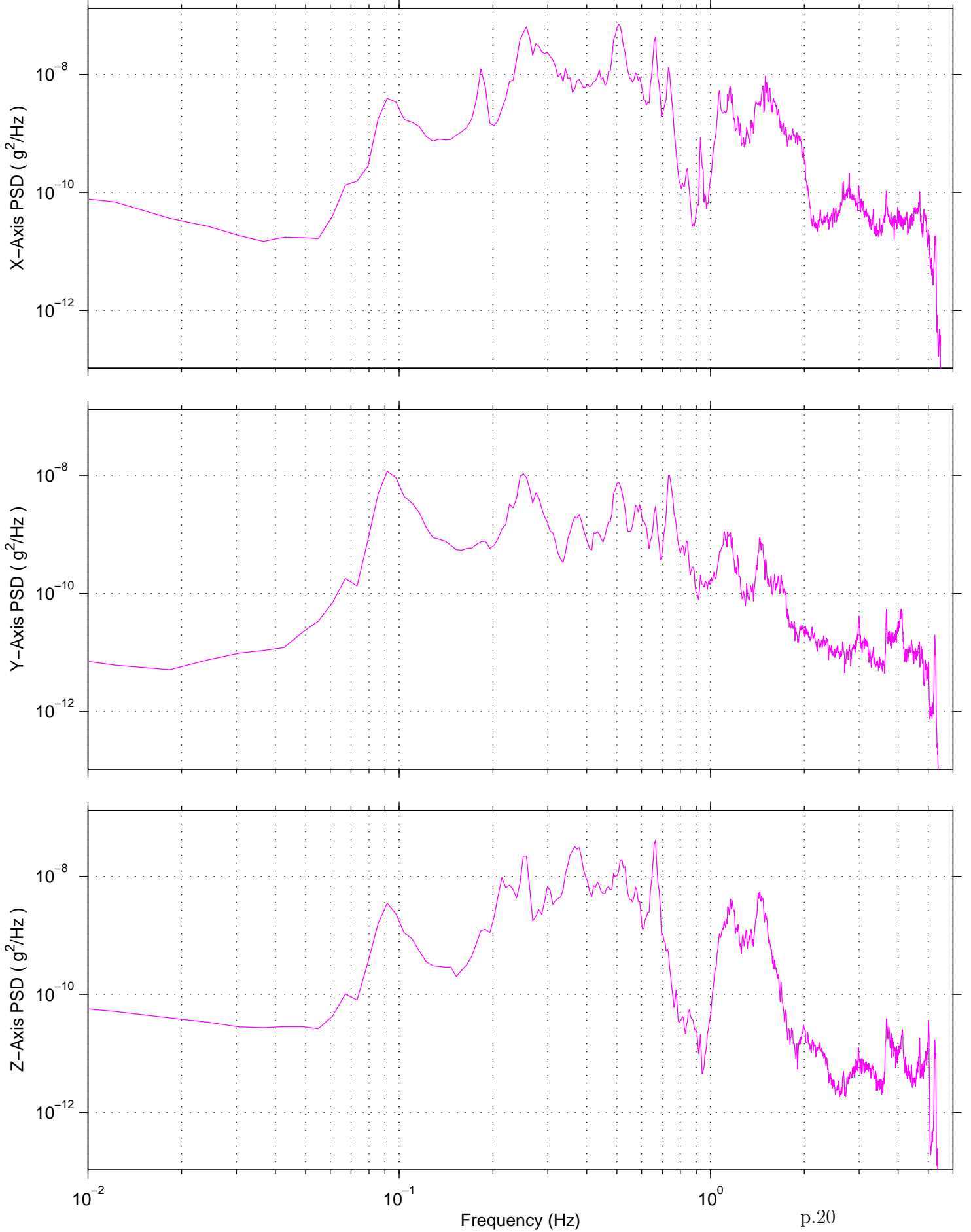
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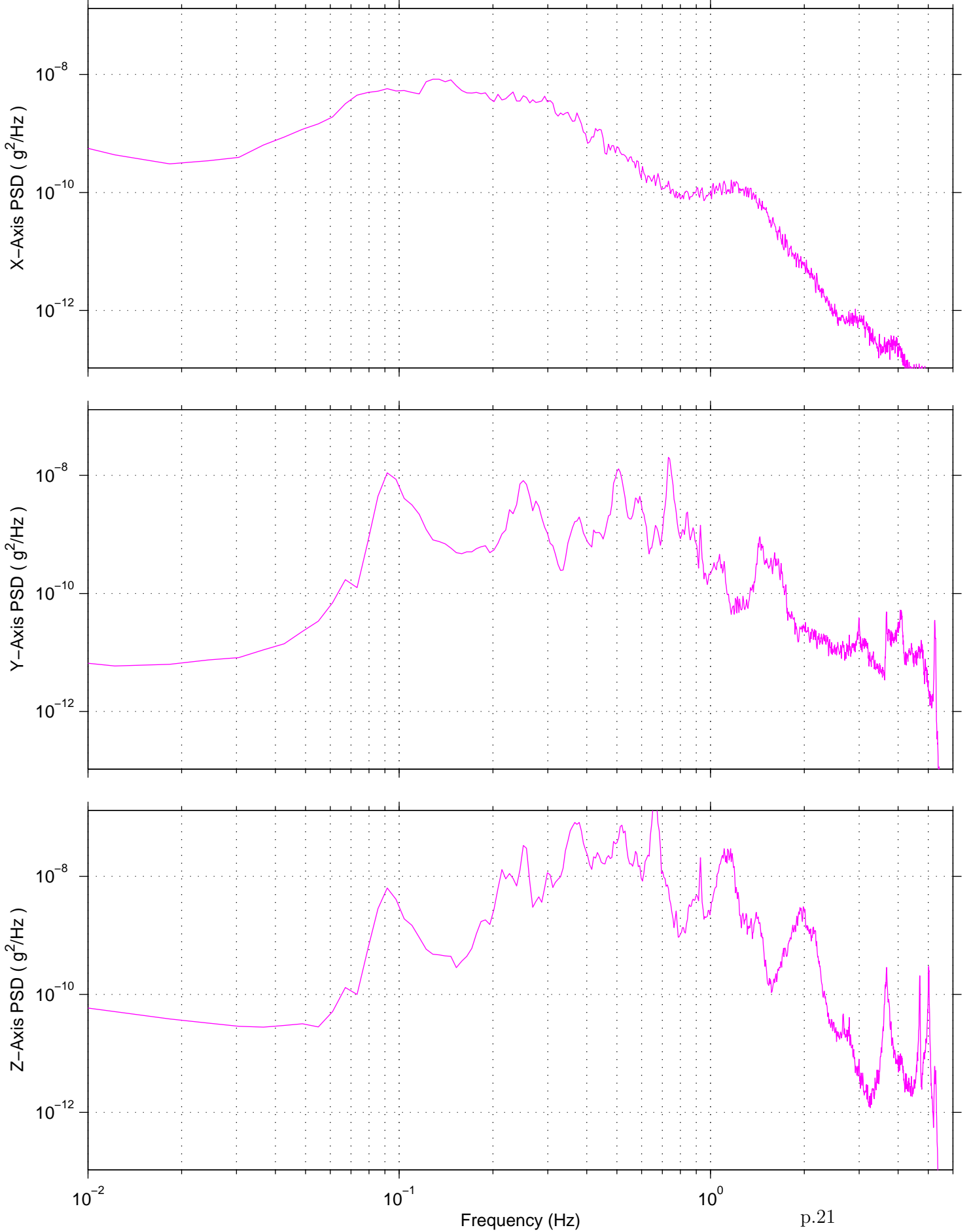
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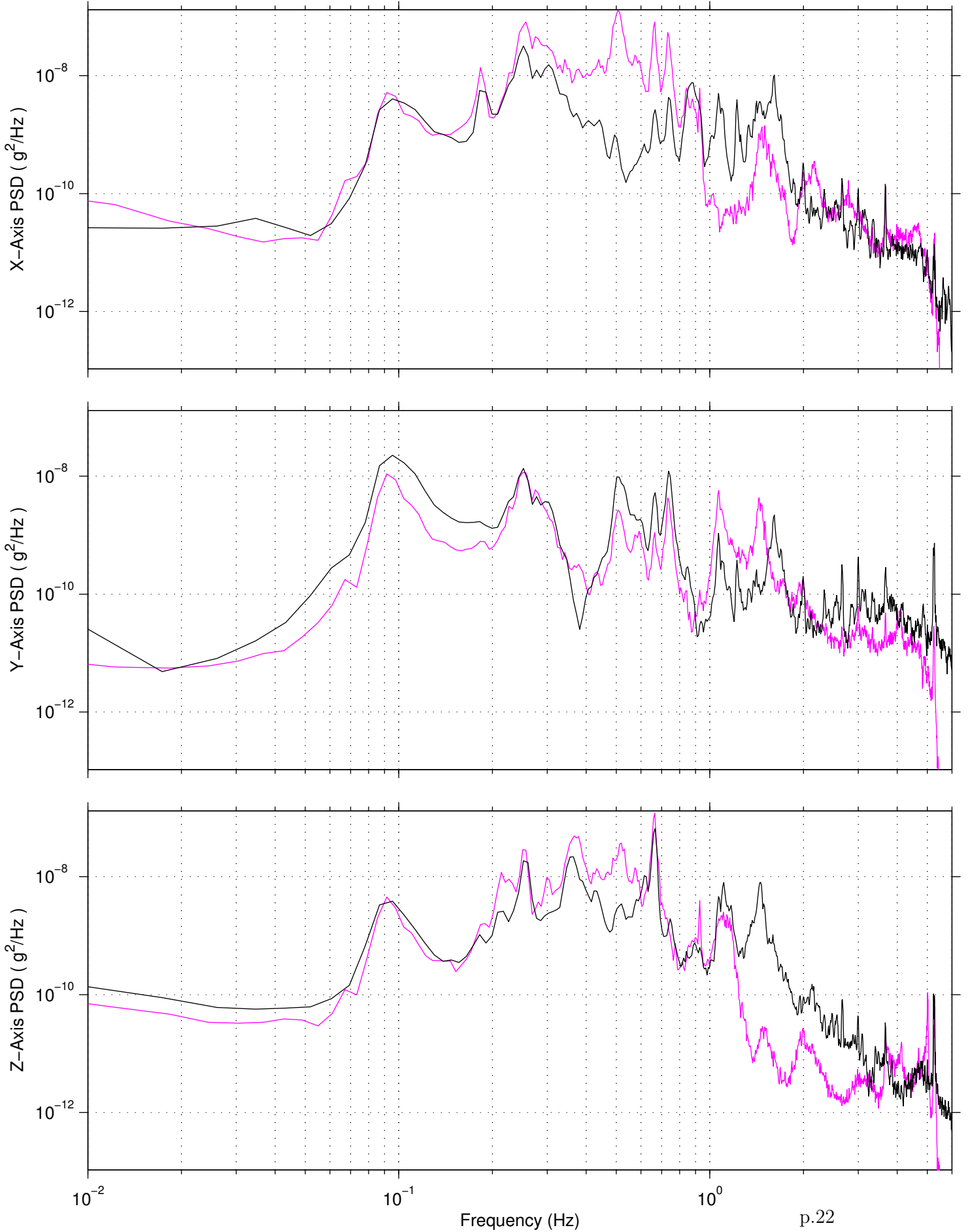
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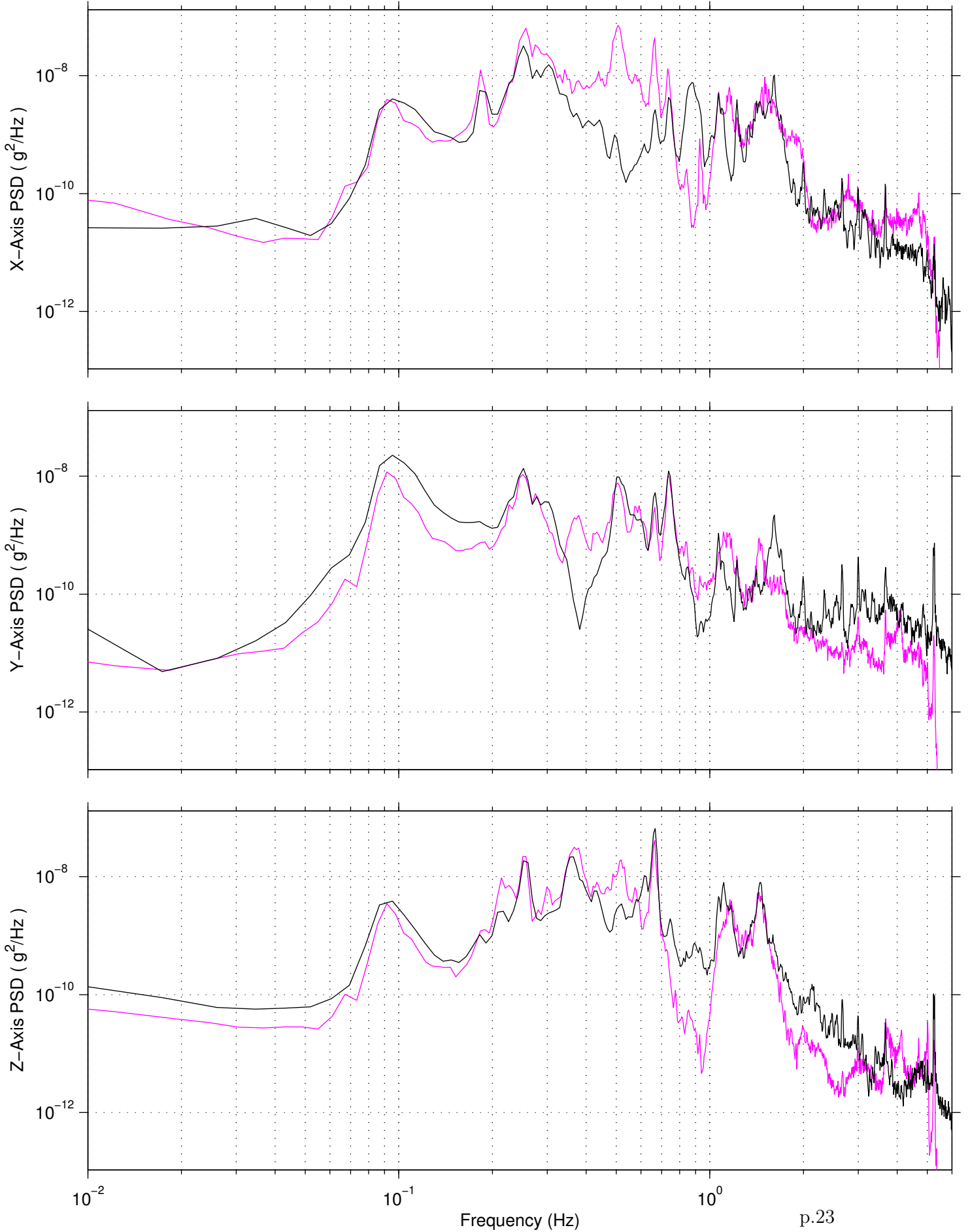
Start GMT 16-August-2018, 228/13:00:04



SAMS2, 121f08006, COL1A3, EPM, near PK-4, 6.0 Hz (142.0 s/sec)
Start GMT 16-August-2018, 228/12:45:00



SAMS2, 121f08006, COL1A3, EPM, near PK-4, 6.0 Hz (142.0 s/sec)
Start GMT 16-August-2018, 228/12:45:00



SAMS2, 121f08006, COL1A3, EPM, near PK-4, 6.0 Hz (142.0 s/sec)
Start GMT 16-August-2018, 228/12:45:00

