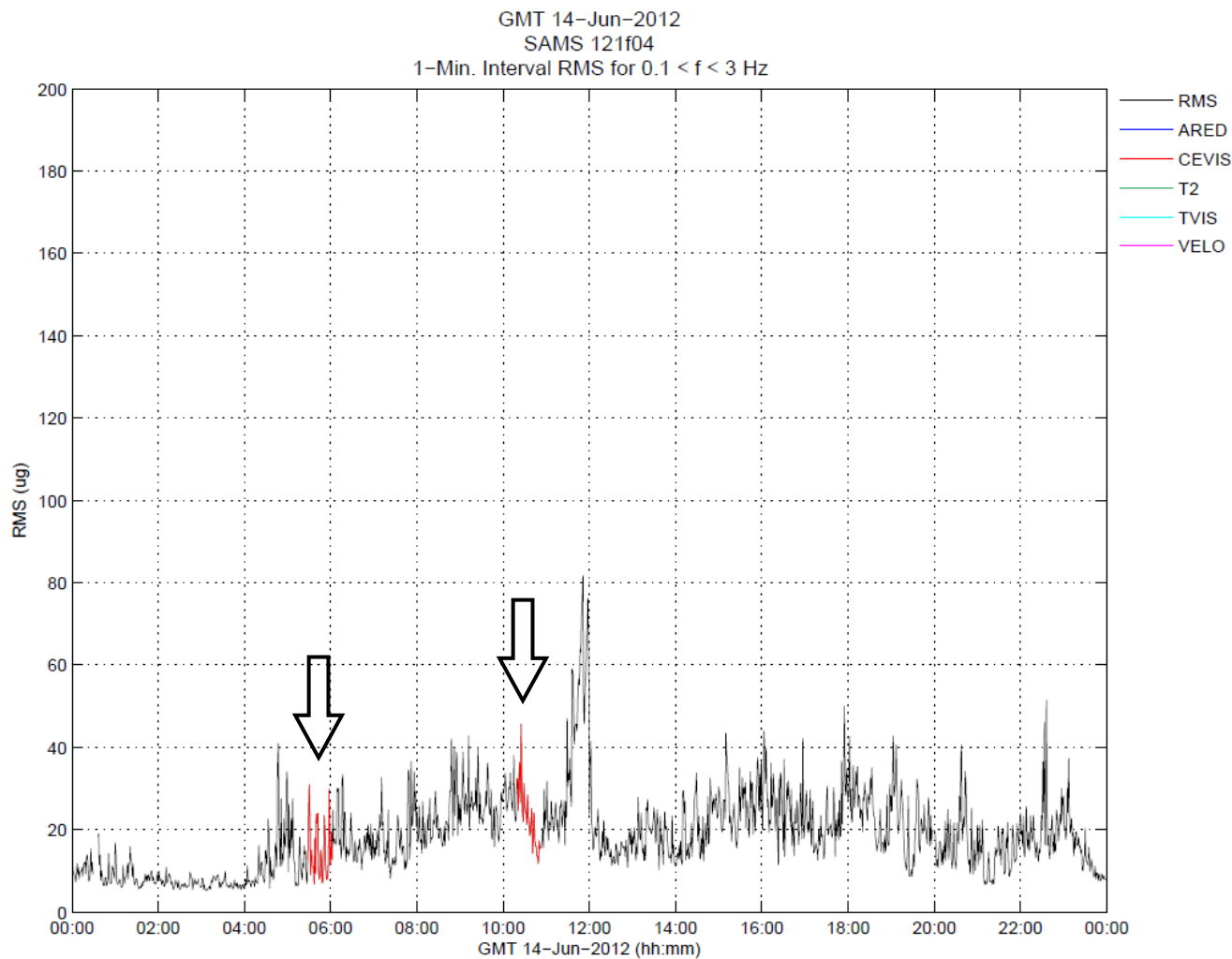


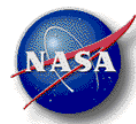
Cycle Ergometer with Vibration Isolation System (CEVIS)



Description	
Sensor	121f04 500 sa/sec (200 Hz)
Location	LAB1O2, ER1, Lower Z Panel
Plot Type	1-Minute Interval RMS for 0.1 < f < 3 Hz

Notes:

- This plot shows the RMS value computed every minute for the entire day over the range from 0.1 to 3 Hz.
- Based on as-run info:
 - The black trace shows the "non-CEVIS" portion of the day.
 - The red trace shows "CEVIS" exercise periods.
- A total of 87 such CEVIS periods across 75 days were used for this analysis with average exercise duration of 27 minutes.
- The 2 most notable observations from these one-minute interval RMS plots are:
 - (1) nominal crew wake levels appear between about 06:00 and 22:00, and
 - (2) the CEVIS periods do not consistently distinguish themselves against the ambient, crew-wake vibratory environment.



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Regime:	Vibratory
Category:	Crew
Source:	CEVIS Exercise

Cycle Ergometer with Vibration Isolation System (CEVIS) Exercise Period Comparison to Crew Sleep and Wake Periods

The analysis and results presented here are based on reported as-run times for 87 CEVIS periods across 75 days. The acceleration data from SAMS sensor 121f04, which was mounted on the lower Z panel of EXPRESS rack 1 in the USL, was the sensor of choice in support of future Protein Crystal Growth investigations on the ISS.

These SAMS data were analyzed to produce one-minute interval RMS data (0.1 to 3 Hz) for the entire day for each day of reported as-run CEVIS periods. The 2 most notable observations from these one-minute interval RMS plots over an entire day are: (1) nominal crew wake levels appear between about 06:00 and 22:00, and (2) the CEVIS periods do not consistently pop up above the ambient vibratory environment during crew wake periods.

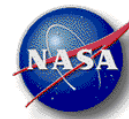
Next, the data were partitioned into 3 data sets: [1] CEVIS periods, [2] non-CEVIS wake periods, and [3] non-CEVIS sleep periods. A histogram was then computed from the one-minute interval RMS data for each of a “total RMS” and a “per-axis RMS” basis for each of the 3 data sets.

Finally, each histogram was integrated to give the cumulative percentage of occurrence at a given RMS level. These results were plotted along with the 95th percentile markers. With the large volume of RMS results aggregated in this way, a statistical distinction was observed for CEVIS periods relative to non-CEVIS crew sleep and wake periods as summarized in the box below.

During CEVIS as-run periods, the RMS level at the SAMS 121f04 location was below about 47.8 ug over 95% of the time.

During non-CEVIS periods, while the crew was awake, the RMS level at the SAMS 121f04 location was below about 35.3 ug over 95% of the time; lower than CEVIS periods, but not sure the difference warrants any special consideration.

During non-CEVIS periods, while the crew was asleep, the RMS level at the SAMS 121f04 location was below about 15.2 ug over 95% of the time; notably lower than CEVIS periods.

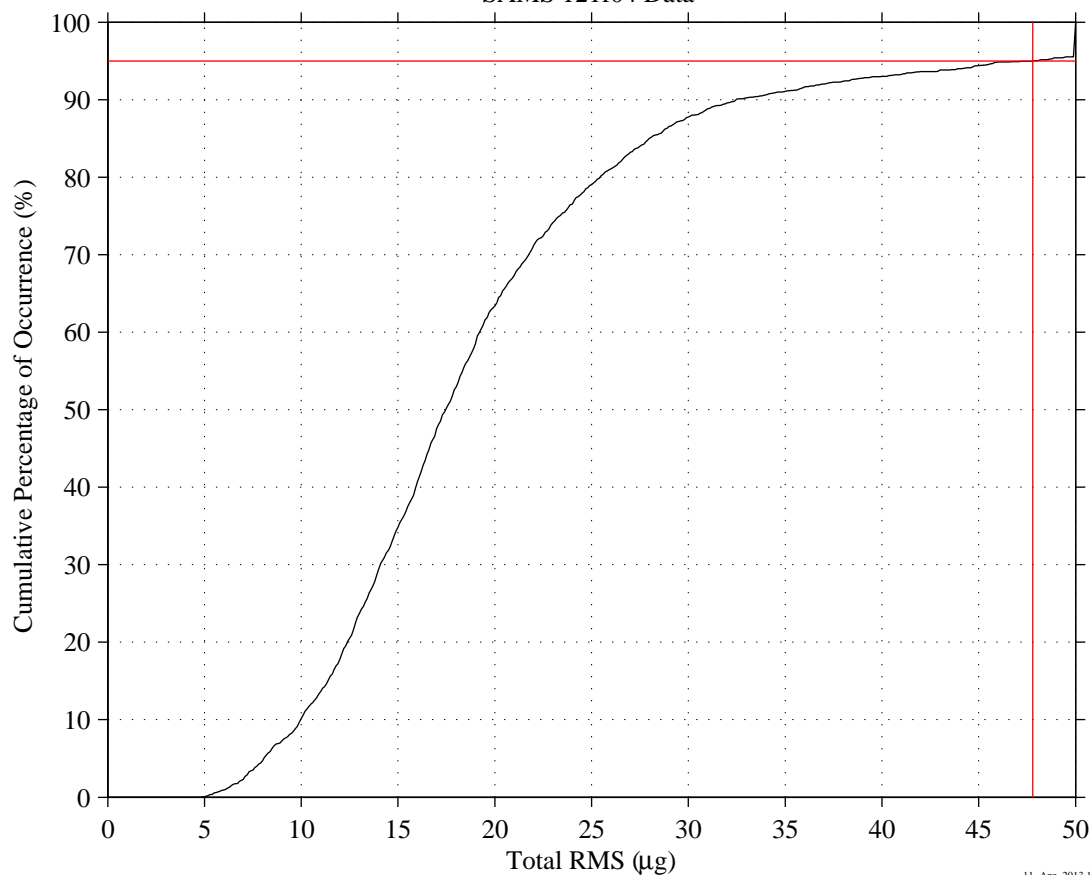


CEVIS Exercise

SAMS, 121f04 at LAB102, ER1, Lower Z Panel
RMS: 0.1 < f < 3 Hz

CEVIS Periods
SAMS 121f04 Data

Cumulative % Occurrence
from Total RMS Histogram



11-Apr-2013 15:04:06

Description	
Sensor	121f04 500 sa/sec (200 Hz)
Location	LAB102, ER1, Lower Z Panel
Plot Type	Σ % Occurrence vs. RMS for 0.1 < f < 3 Hz

Notes:

- The black trace shows the cumulative percentage of occurrence calculated from RMS histogram.
- The red cross-hairs mark the 95th percentile.



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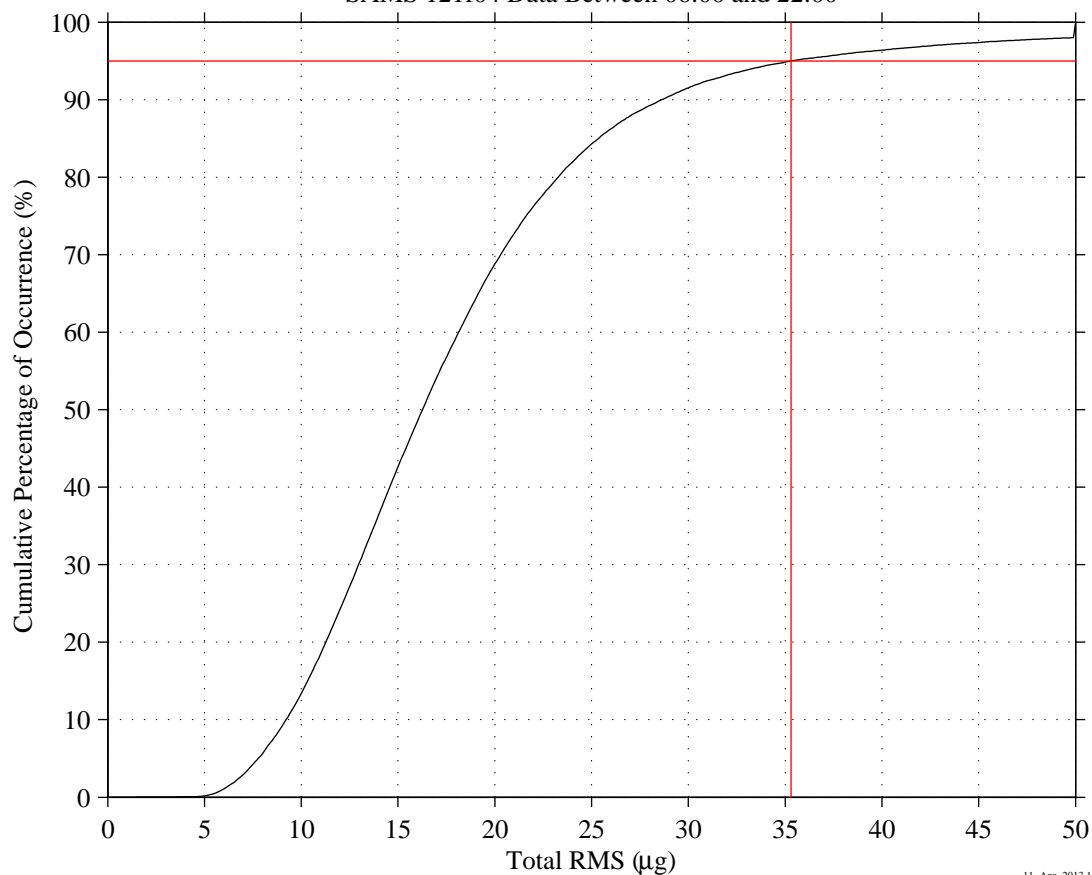
Regime:	Vibratory
Category:	Crew
Source:	CEVIS Exercise

Non-CEVIS "Wake" Periods

SAMS, 121f04 at LAB1O2, ER1, Lower Z Panel
 RMS: $0.1 < f < 3$ Hz

SAMS 121f04 Data Between 06:00 and 22:00

Cumulative % Occurrence from Total RMS Histogram



11-Apr-2013 15:04:13

Description	
Sensor	121f04 500 sa/sec (200 Hz)
Location	LAB1O2, ER1, Lower Z Panel
Plot Type	Σ % Occurrence vs. RMS for $0.1 < f < 3$ Hz

Notes:

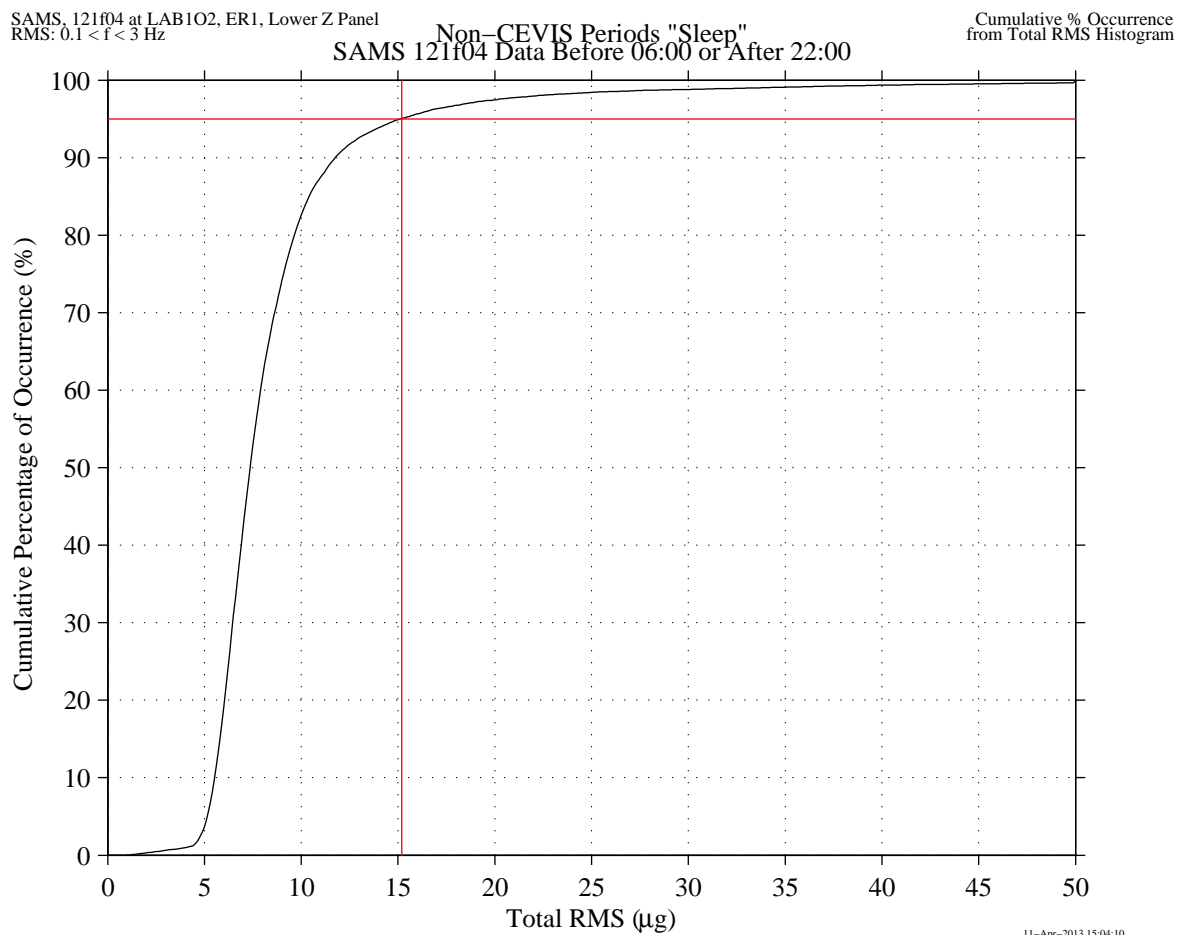
- The black trace shows the cumulative percentage of occurrence calculated from RMS histogram.
- The red cross-hairs mark the 95th percentile.



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Regime:	Vibratory
Category:	Crew
Source:	CEVIS Exercise

Non-CEVIS "Sleep" Periods



Description	
Sensor	121f04 500 sa/sec (200 Hz)
Location	LAB102, ER1, Lower Z Panel
Plot Type	Σ % Occurrence vs. RMS for 0.1 < f < 3 Hz

Notes:

- The black trace shows the cumulative percentage of occurrence calculated from RMS histogram.
- The red cross-hairs mark the 95th percentile.



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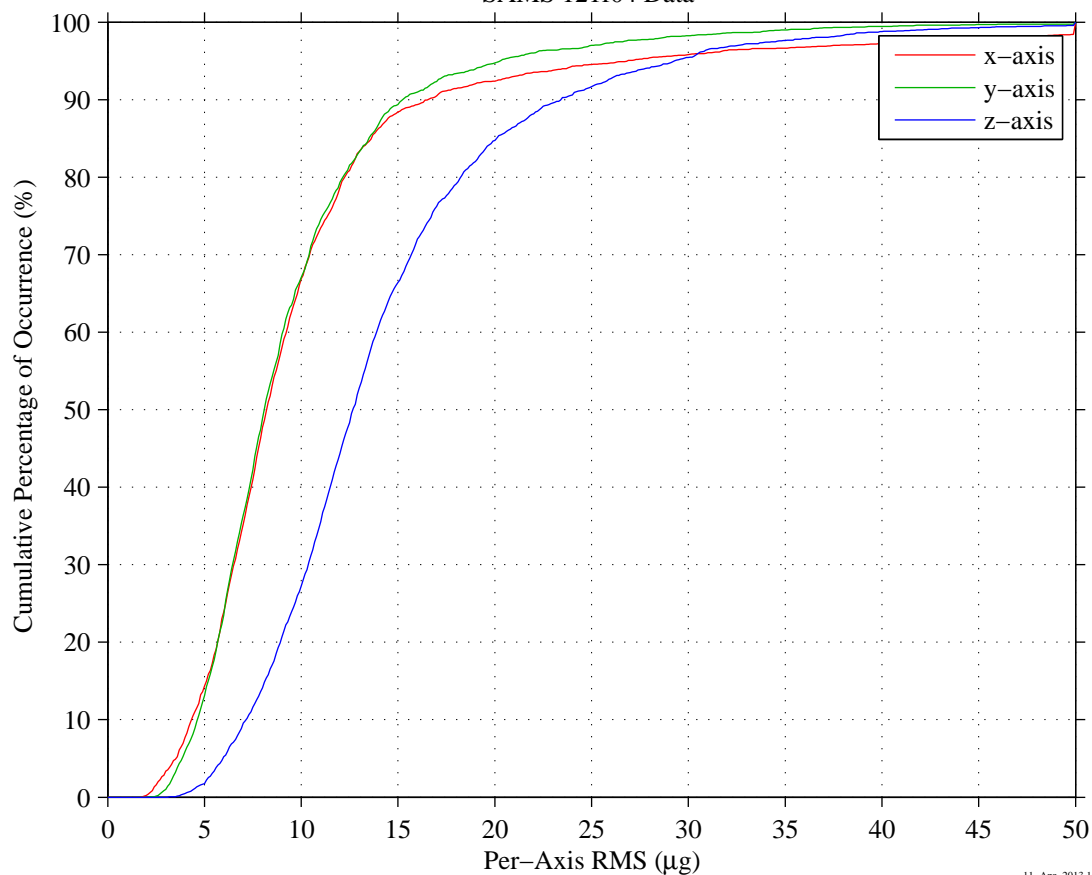
Regime:	Vibratory
Category:	Crew
Source:	CEVIS Exercise

CEVIS Periods

SAMS, 121f04 at LAB102, ER1, Lower Z Panel
RMS: 0.1 < f < 3 Hz

CEVIS Periods
SAMS 121f04 Data

Cumulative % Occurrence
from Per-Axis RMS Histograms



11-Apr-2013 15:04:06

Description	
Sensor	121f04 500 sa/sec (200 Hz)
Location	LAB102, ER1, Lower Z Panel
Plot Type	Σ % Occurrence vs. RMS for 0.1 < f < 3 Hz, Per-Axis

Notes:

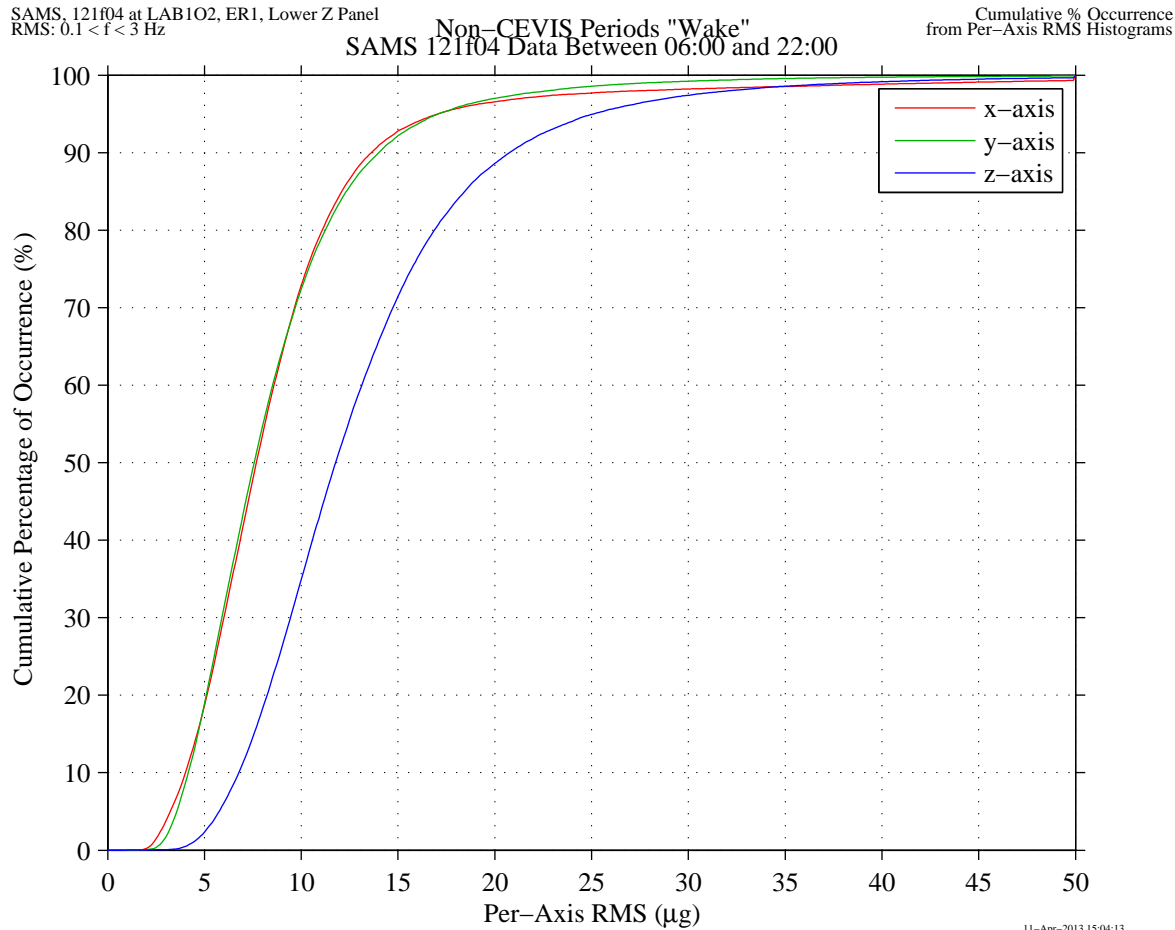
- The **red** trace shows the cumulative percentage of occurrence vs. RMS calculated from the histogram for the Space Station Analysis (SSA) **X-axis**.
- The **green** trace shows the cumulative percentage of occurrence vs. RMS calculated from the histogram for the Space Station Analysis (SSA) **Y-axis**.
- The **blue** trace shows the cumulative percentage of occurrence vs. RMS calculated from the histogram for the Space Station Analysis (SSA) **Z-axis**.



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Regime:	Vibratory
Category:	Crew
Source:	CEVIS Exercise

Non-CEVIS “Wake” Periods



Description	
Sensor	121f04 500 sa/sec (200 Hz)
Location	LAB1O2, ER1, Lower Z Panel
Plot Type	Σ % Occurrence vs. RMS for 0.1 < f < 3 Hz, Per-Axis

Notes:

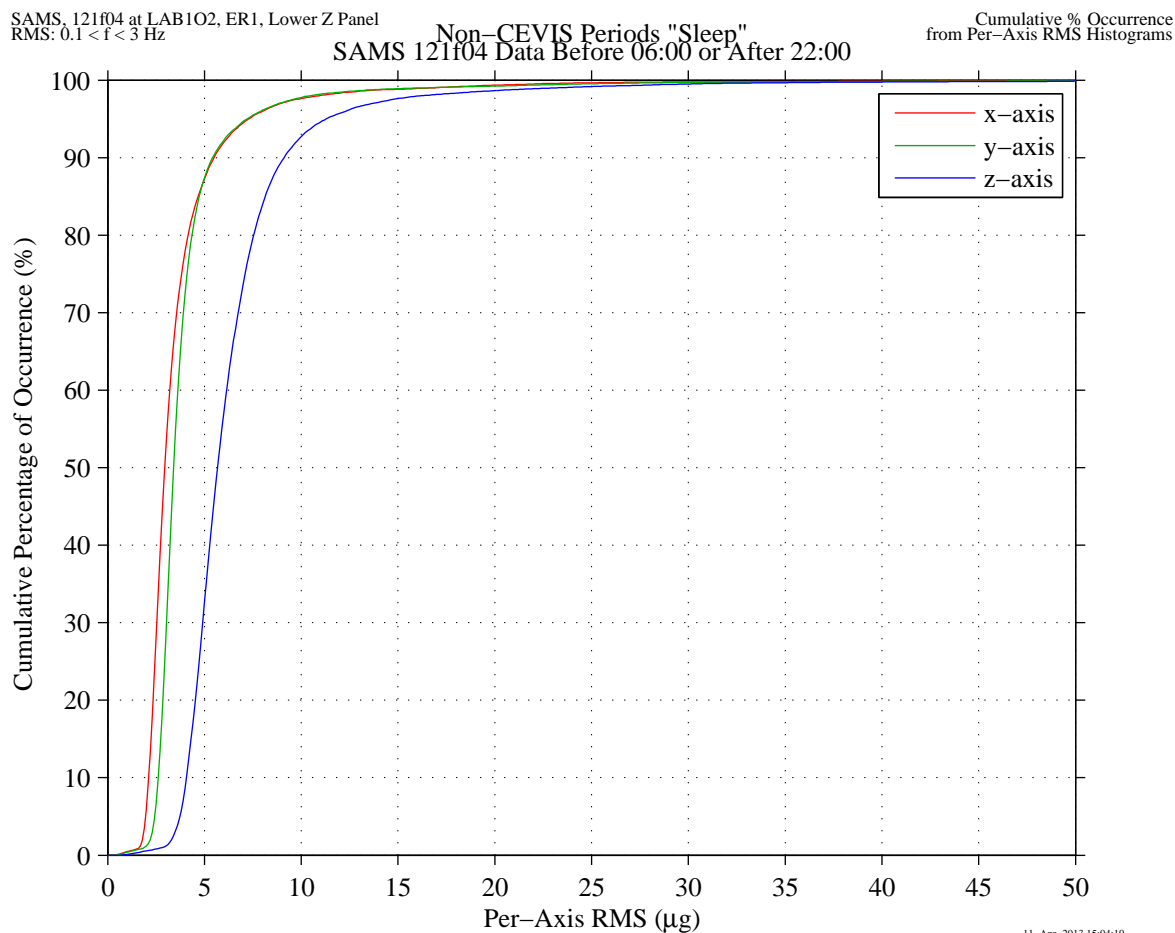
- The **red** trace shows the cumulative percentage of occurrence vs. RMS calculated from the histogram for the Space Station Analysis (SSA) **X-axis**.
- The **green** trace shows the cumulative percentage of occurrence vs. RMS calculated from the histogram for the Space Station Analysis (SSA) **Y-axis**.
- The **blue** trace shows the cumulative percentage of occurrence vs. RMS calculated from the histogram for the Space Station Analysis (SSA) **Z-axis**.



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Regime:	Vibratory
Category:	Crew
Source:	CEVIS Exercise

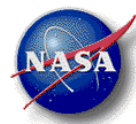
Non-CEVIS “Sleep” Periods



Description	
Sensor	121f04 500 sa/sec (200 Hz)
Location	LAB1O2, ER1, Lower Z Panel
Plot Type	Σ % Occurrence vs. RMS for 0.1 < f < 3 Hz, Per-Axis

Notes:

- The **red** trace shows the cumulative percentage of occurrence vs. RMS calculated from the histogram for the Space Station Analysis (SSA) **X-axis**.
- The **green** trace shows the cumulative percentage of occurrence vs. RMS calculated from the histogram for the Space Station Analysis (SSA) **Y-axis**.
- The **blue** trace shows the cumulative percentage of occurrence vs. RMS calculated from the histogram for the Space Station Analysis (SSA) **Z-axis**.



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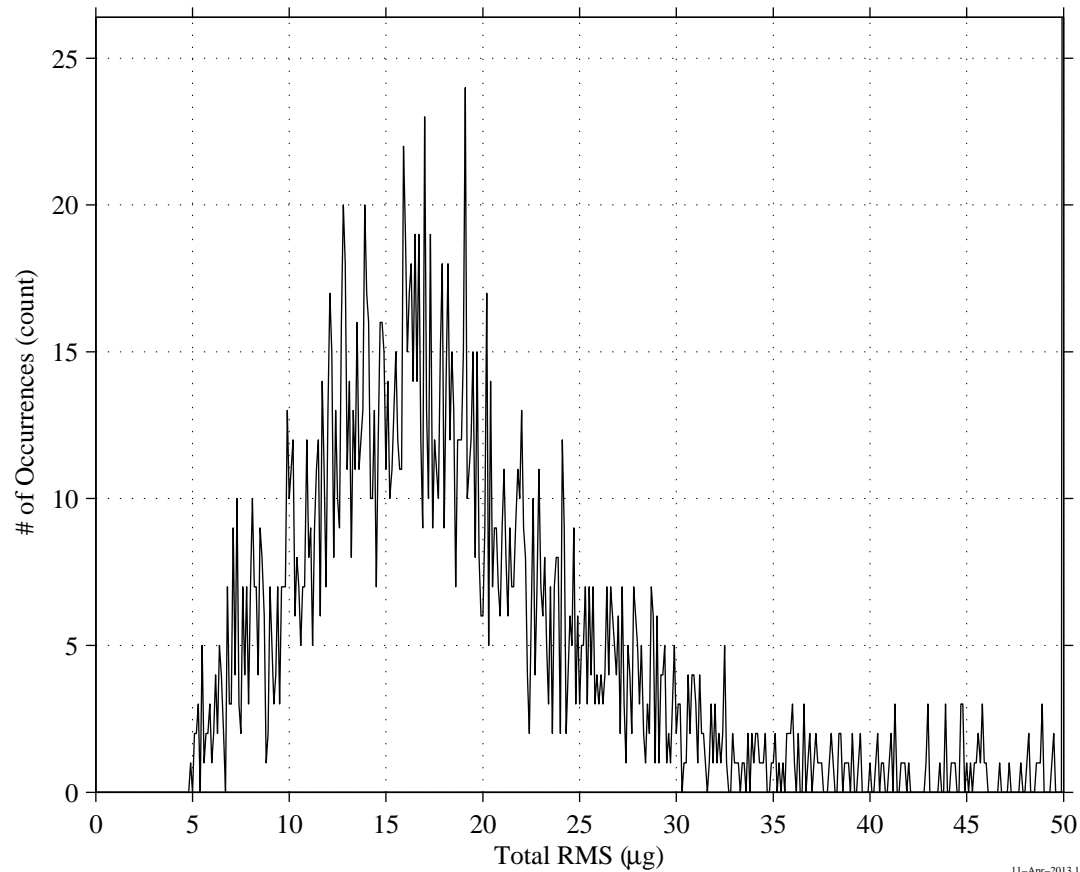
Regime:	Vibratory
Category:	Crew
Source:	CEVIS Exercise

CEVIS Periods

SAMS, 121f04 at LAB1O2, ER1, Lower Z Panel
RMS: $0.1 < f < 3$ Hz

CEVIS Periods
SAMS 121f04 Data

Total RMS
Histogram



11-Apr-2013 15:04:06

Description	
Sensor	121f04 500 sa/sec (200 Hz)
Location	LAB1O2, ER1, Lower Z Panel
Plot Type	RMS Histogram for $0.1 < f < 3$ Hz

Notes:

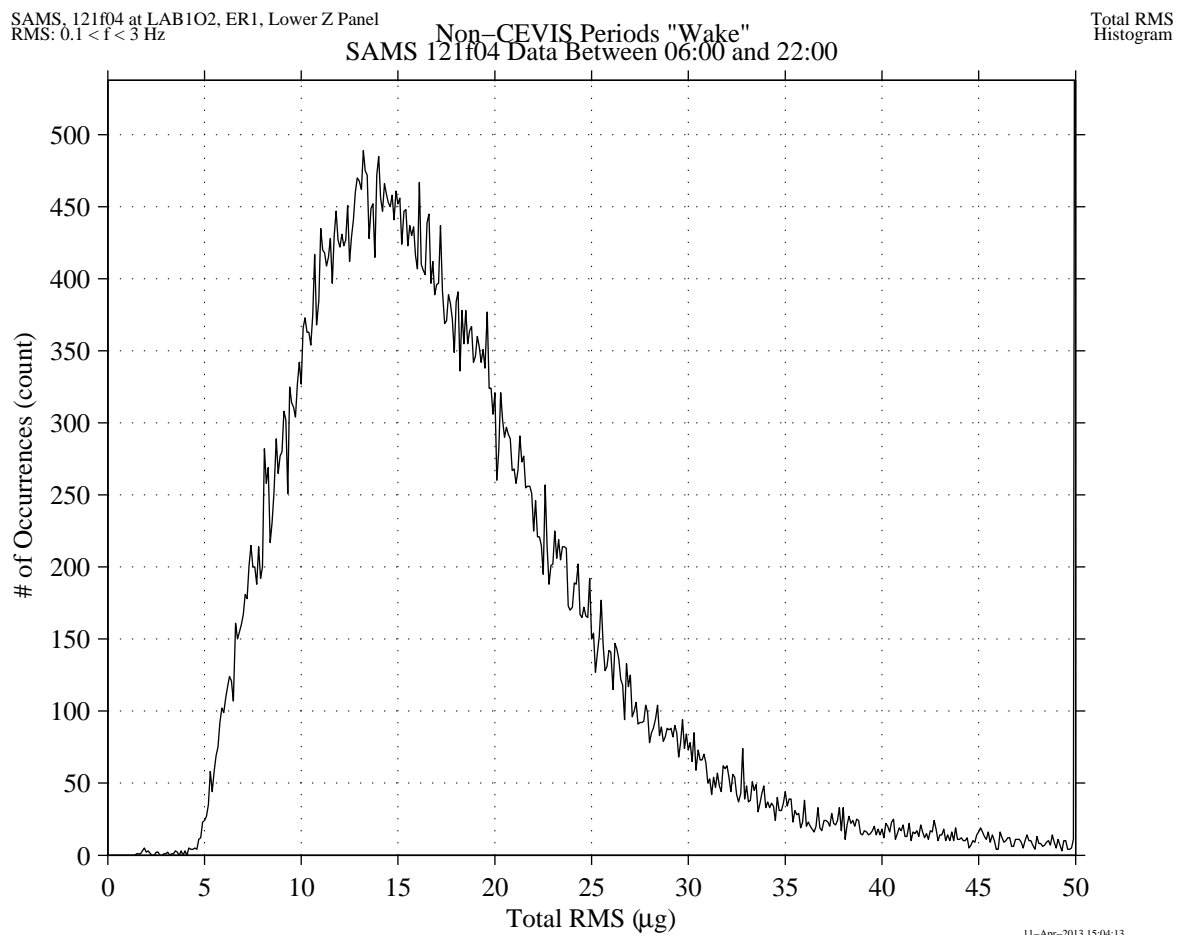
- The black trace shows the RMS histogram for this sensor location.



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Regime:	Vibratory
Category:	Crew
Source:	CEVIS Exercise

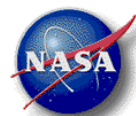
Non-CEVIS “Wake” Periods



Description	
Sensor	121f04 500 sa/sec (200 Hz)
Location	LAB1O2, ER1, Lower Z Panel
Plot Type	RMS Histogram for $0.1 < f < 3$ Hz

Notes:

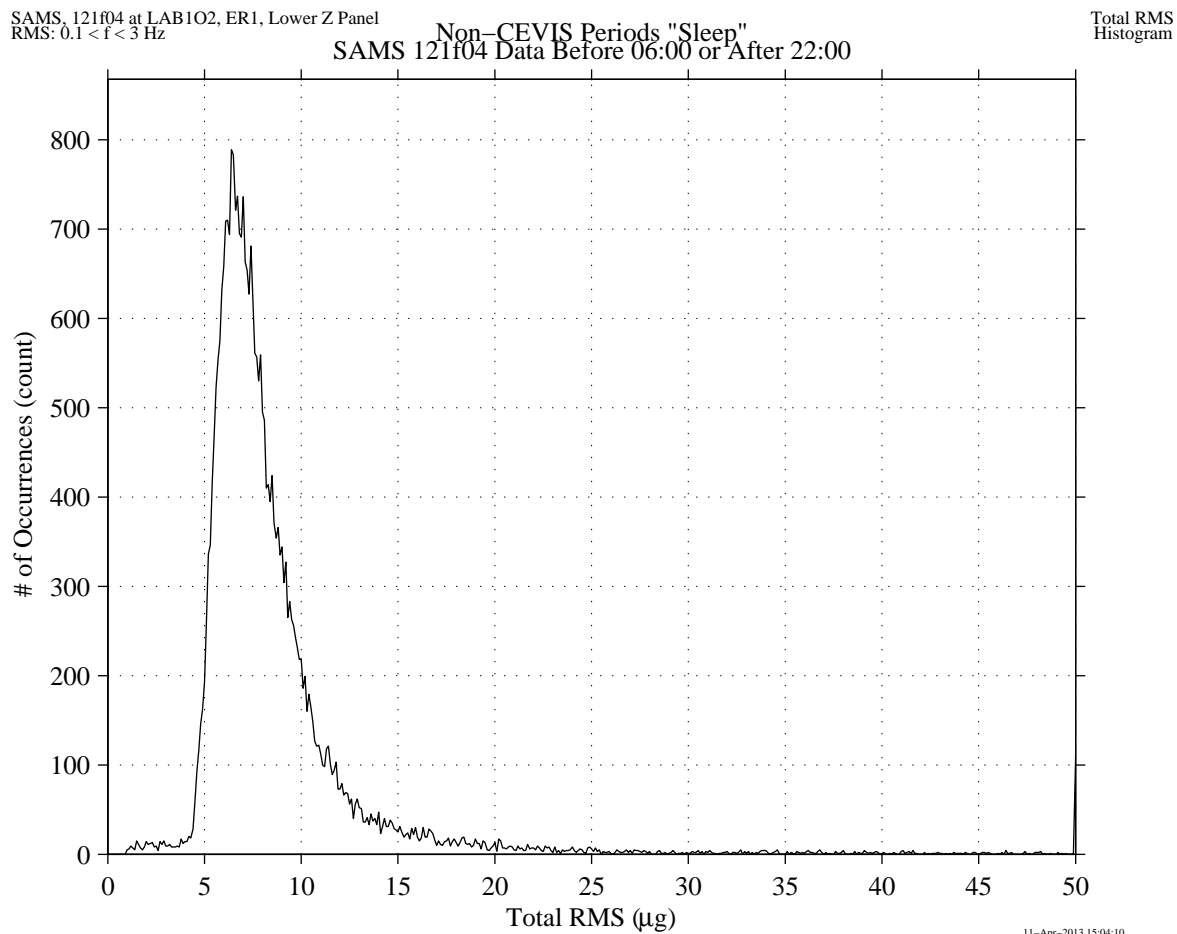
- The black trace shows the RMS histogram for this sensor location.



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Regime:	Vibratory
Category:	Crew
Source:	CEVIS Exercise

Non-CEVIS "Sleep" Periods



Description	
Sensor	121f04 500 sa/sec (200 Hz)
Location	LAB102, ER1, Lower Z Panel
Plot Type	RMS Histogram for $0.1 < f < 3$ Hz

Notes:

- The black trace shows the RMS histogram for this sensor location.



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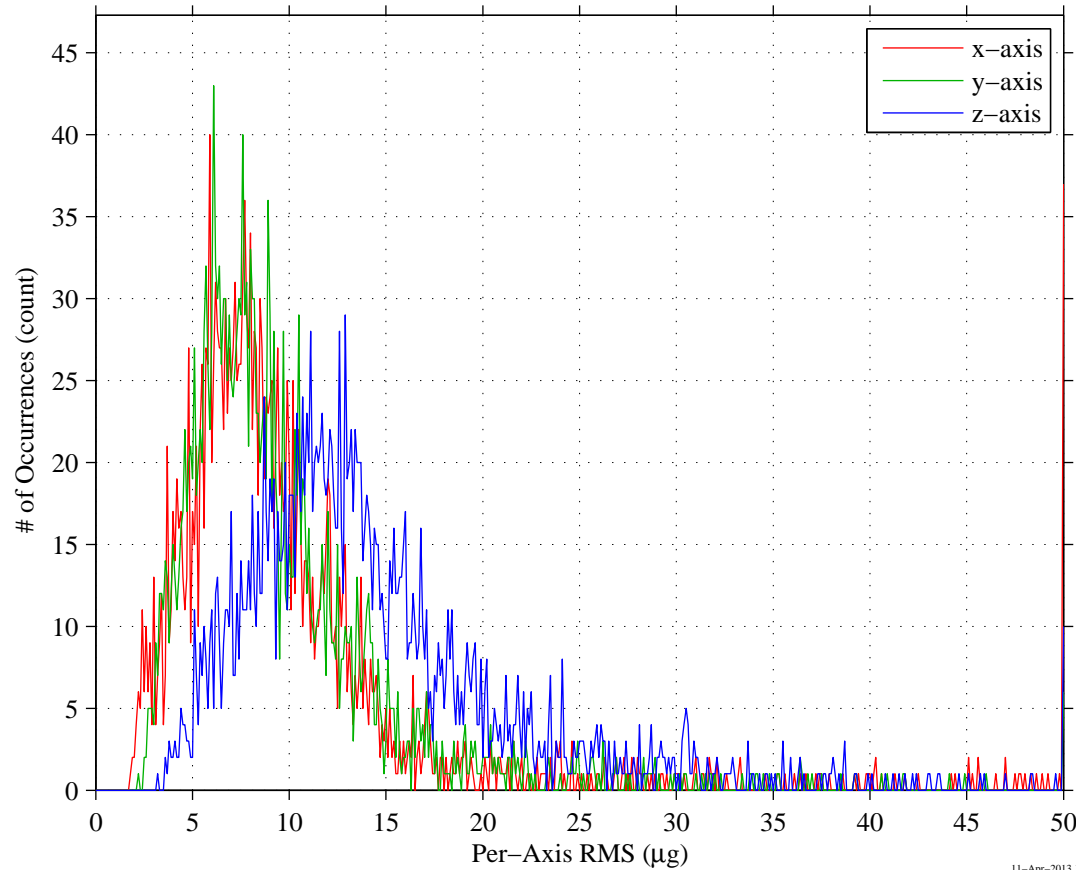
Regime:	Vibratory
Category:	Crew
Source:	CEVIS Exercise

CEVIS Periods

SAMS, 121f04 at LAB102, ER1, Lower Z Panel
RMS: $0.1 < f < 3$ Hz

CEVIS Periods
SAMS 121f04 Data

Per-Axis RMS
Histogram



11-Apr-2013 15:04:06

Description	
Sensor	121f04 500 sa/sec (200 Hz)
Location	LAB102, ER1, Lower Z Panel
Plot Type	Per-Axis RMS Histogram for $0.1 < f < 3$ Hz

Notes:

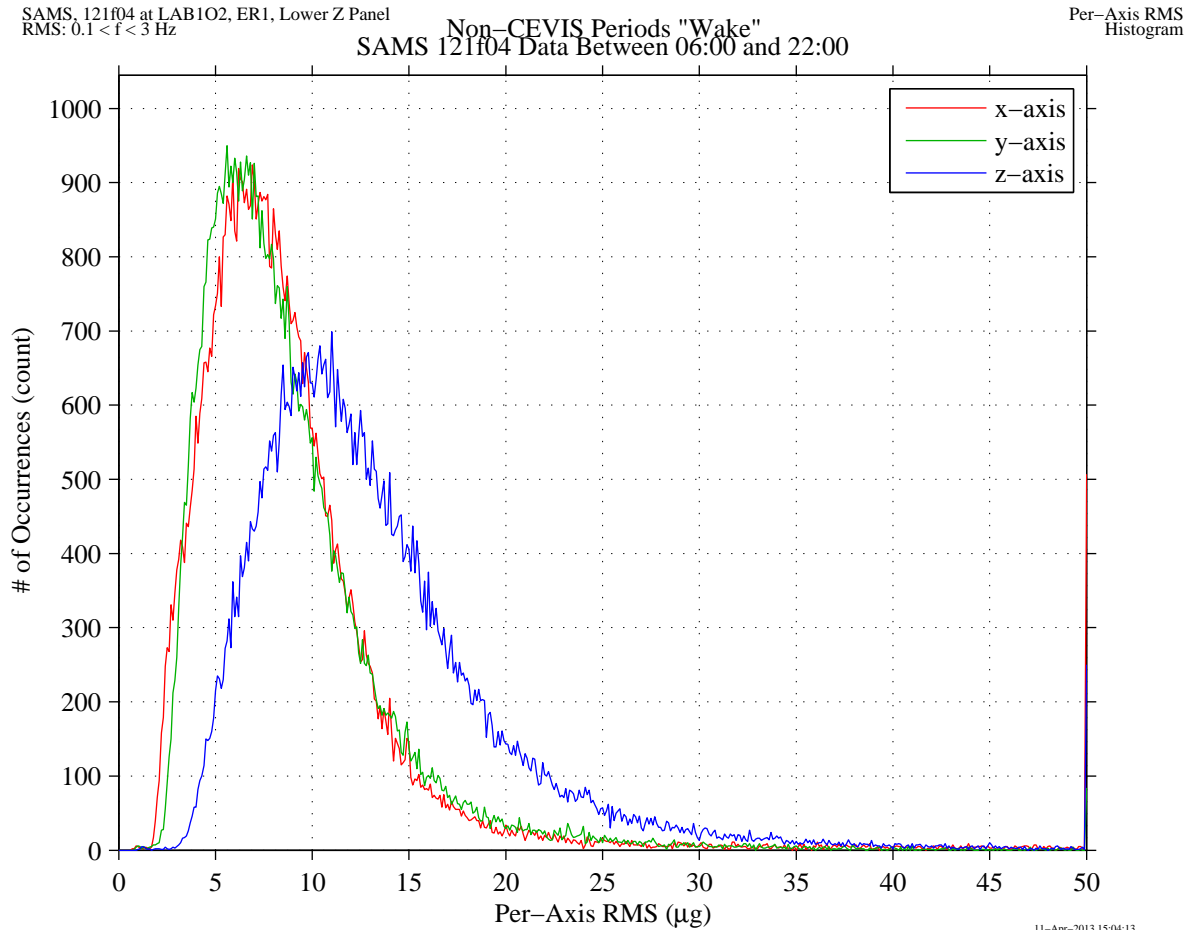
- The **red** trace shows the RMS histogram for the Space Station Analysis (SSA) **X-axis**.
- The **green** trace shows the RMS histogram for the Space Station Analysis (SSA) **Y-axis**.
- The **blue** trace shows the RMS histogram for the Space Station Analysis (SSA) **Z-axis**.



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Regime:	Vibratory
Category:	Crew
Source:	CEVIS Exercise

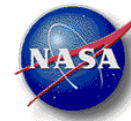
Non-CEVIS “Wake” Periods



Description	
Sensor	121f04 500 sa/sec (200 Hz)
Location	LAB102, ER1, Lower Z Panel
Plot Type	Per-Axis RMS Histogram for $0.1 < f < 3$ Hz

Notes:

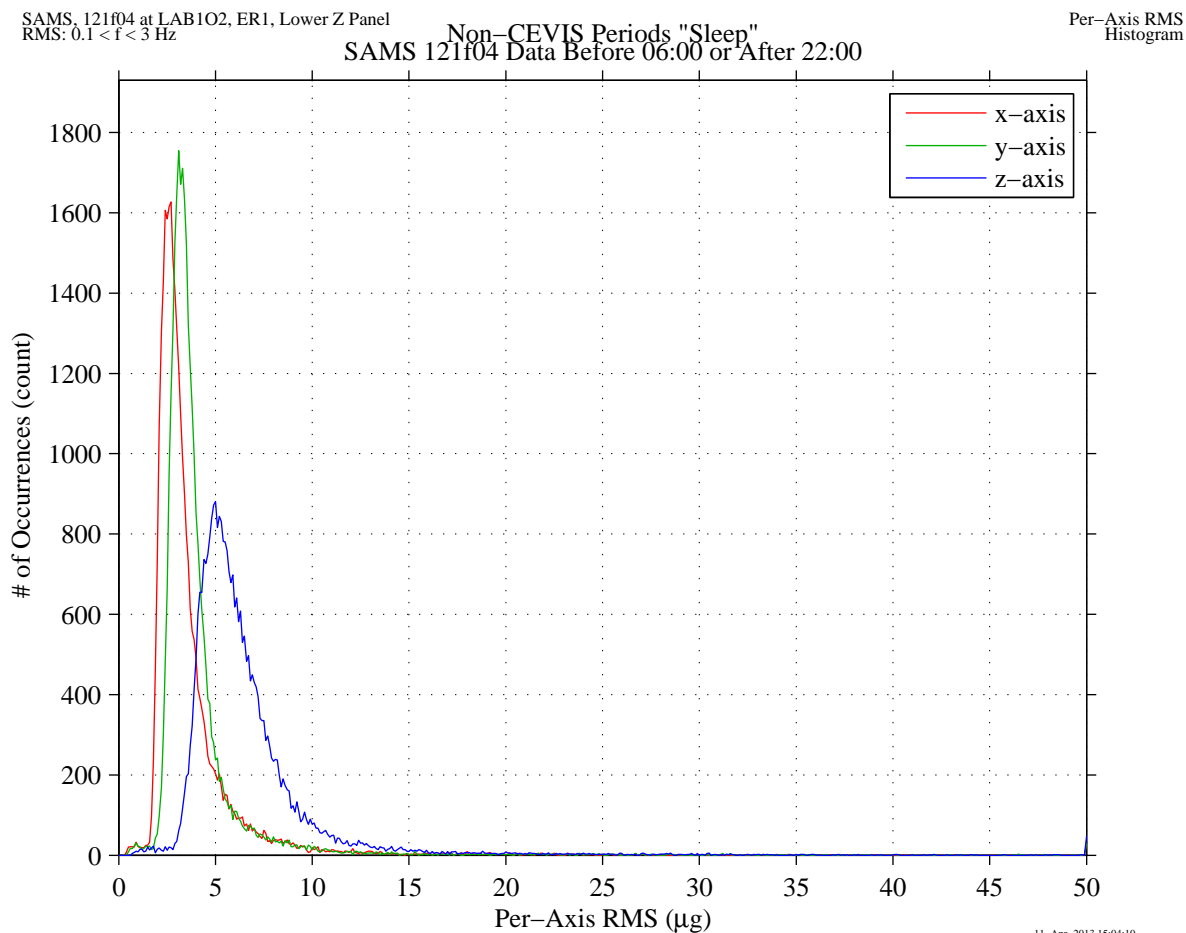
- The **red** trace shows the RMS histogram for the Space Station Analysis (SSA) **X-axis**.
- The **green** trace shows the RMS histogram for the Space Station Analysis (SSA) **Y-axis**.
- The **blue** trace shows the RMS histogram for the Space Station Analysis (SSA) **Z-axis**.



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Regime:	Vibratory
Category:	Crew
Source:	CEVIS Exercise

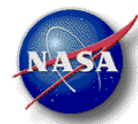
Non-CEVIS "Sleep" Periods



Description	
Sensor	121f04 500 sa/sec (200 Hz)
Location	LAB102, ER1, Lower Z Panel
Plot Type	Per-Axis RMS Histogram for $0.1 < f < 3$ Hz

Notes:

- The **red** trace shows the RMS histogram for the Space Station Analysis (SSA) **X-axis**.
- The **green** trace shows the RMS histogram for the Space Station Analysis (SSA) **Y-axis**.
- The **blue** trace shows the RMS histogram for the Space Station Analysis (SSA) **Z-axis**.



Glenn Research Center

Regime:	Vibratory
Category:	Crew
Source:	CEVIS Exercise

Cycle Ergometer with Vibration Isolation System (CEVIS) Ancillary Information



The CEVIS system is designed for use as a component of the Crew Health Care System (CHeCS) and Human Research Facility (HRF) on the ISS. CEVIS provides aerobic and cardiovascular conditioning through cycling activities. CEVIS also has the capability to support ISS science experiments, pre-breathe extravehicular activities (EVAs), periodic fitness evaluations (PFEs), and pre-landing fitness evaluations. CEVIS is operated in the United States Laboratory Module (USL) and usage depends on crewmember exercise preference.

CEVIS is a modified version of the Shuttle Inertial Vibration Isolation and Stabilization (IVIS) Cycle Ergometer with the principal difference being the addition of an electronic control system. CEVIS is computer-controlled and maintains an accurate workload independent of the pedaling speed of the crewmember.

