Appendix C SAMS Color Spectrograms

The SAMS data have been further processed to produce the plots shown here. Color spectrograms are used to show how the microgravity environment varies in intensity with respect to both the time and frequency domains. These spectrograms are provided as an overview of the frequency characteristics of the SAMS data during the mission. Each spectrogram is a composite of two-hour's worth of data. The time resolution used to compute the spectrograms seen here is 16.384 seconds. This corresponds to a frequency resolution of 0.0610 Hz.

The spectrograms contained herein differ from those spectrograms produced for PIMS mission summary reports prior to January 1996. Previous spectrograms utilized a colormap which had 8 colors. The new spectrograms contain 64 colors. Thus, the magnitude resolution (as represented by the color) shows a significant improvement. Care should be taken to not confuse the current colormap system with that used in reports prior to January 1996. For example, in previous spectrograms, yellow represented a higher magnitude than did red. The new colormap system is opposite when it comes to the yellow-red relation. The user is advised to refer to the colormap key located next to each spectrogram plot.

In order to produce the spectrogram image, Power Spectral Densities (PSDs) were computed for successive time intervals (the length of the interval is equal to the time resolution). For the PSD computation, a boxcar window was applied. In order to combine all three axes into a single plot to show an overall level, a Vector-Magnitude (VM) operation was performed.

Stated mathematically: $\mathrm{VM} = \sqrt{\mathrm{PSD}^2_{x_k} + \mathrm{PSD}^2_{y_k} + \mathrm{PSD}^2_{z_k}}$.

By imaging the base 10 logarithm ($\log_{10}$) magnitude as a color and stacking successive PSDs from left to right, variations of acceleration magnitude and frequency are shown as a function of time. Colors are assigned to discrete magnitude ranges, so that there are 64 colors assigned to the entire range of magnitudes shown. Data which fall outside of the maximum and minimum magnitude limits will be imaged as either the highest or lowest magnitude, depending on which side they have saturated. For this report, 0.01% of the total points lie below the lower limit, and 0.25% of the total points lie above the upper limit. If an area of interest seems to be saturated, care should be taken in that the actual values may lie above or below the color mapping shown on the plot.

Plot gaps (if any exist) are shown by either white or dark blue areas on the page. Care should be taken to not mistake a plot gap (represented by a dark blue vertical band) with a quiet period. If a plot gap exists for an entire plot (or series of successive plots), a comment is placed on the page to let the user know there is a gap in the data. These "no data available" comments will not show exact times for which the data are not available, but will only indicate missing plots.

Due to the nature of spectrograms, care should be taken to not merely read a color's numeric value as being the "amount" of acceleration that is present at a given frequency. In order to get this type of information, the PSDs must be integrated between two frequencies. These frequencies (lower and upper) form the "band" of interest

$$g_{RMS} = \int_{f_1}^{f_2} PSD \cdot df \, .$$

The result of this integration is the g_{RMS} acceleration level in the $\left[f_{lower}, f_{upper}\right]$ band.

The PIMS group is able to provide this type of analysis on a per-request basis. To request this additional analysis, send an e-mail to pims@lerc.nasa.gov, or FAX a request to (216) 433-8545.

Figure 1: USML−1, Head C (fc=25 Hz)

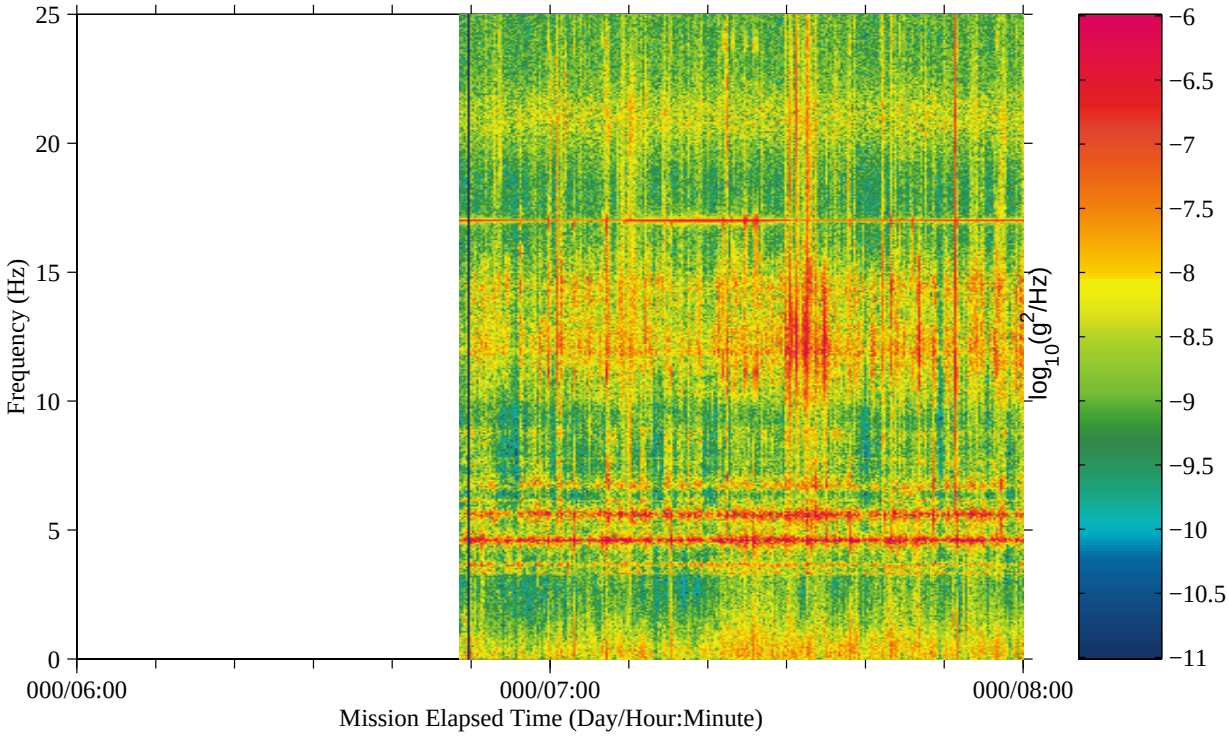

Figure 2: USML−1, Head C (fc=25 Hz)

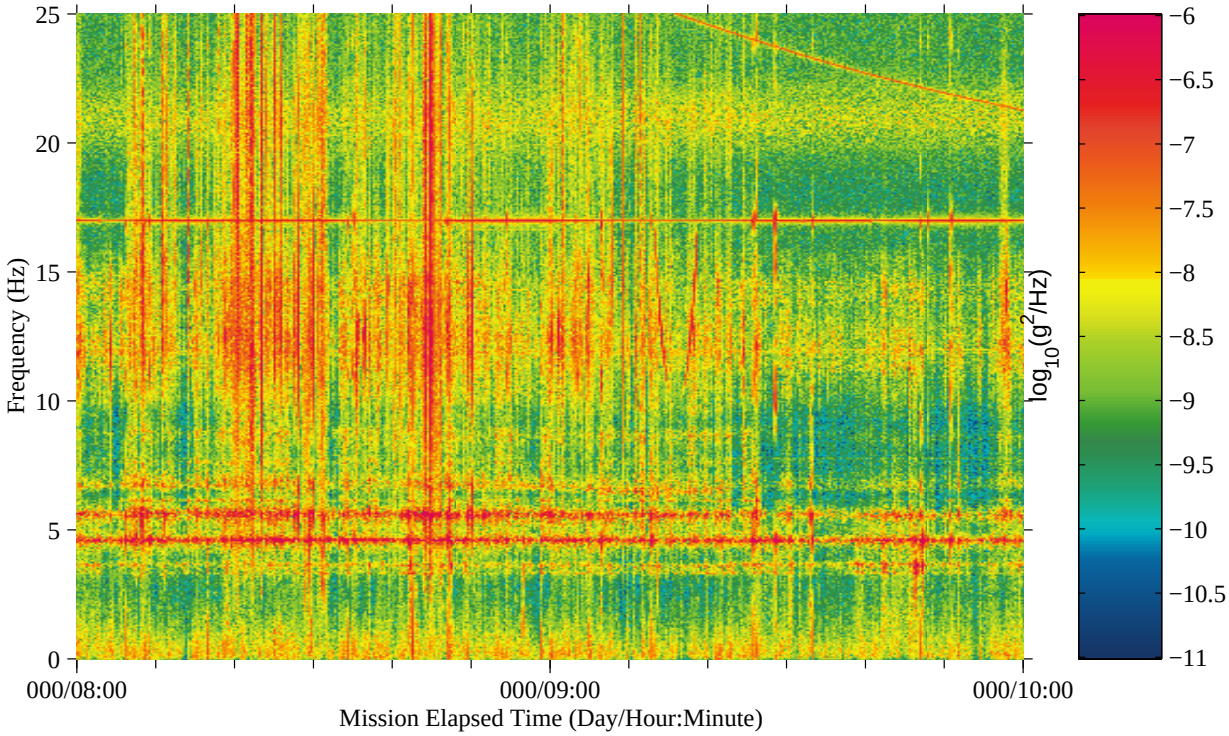

Figure 3: USML−1, Head C (fc=25 Hz)

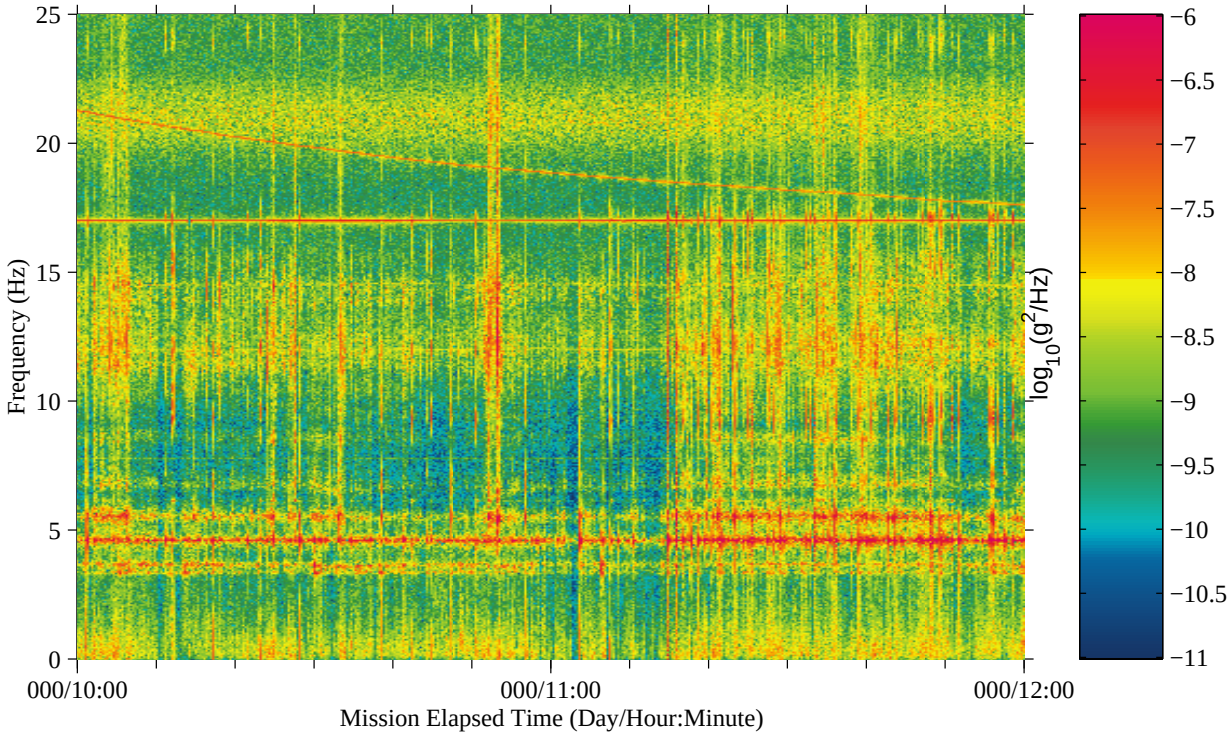

Figure 4: USML−1, Head C (fc=25 Hz)

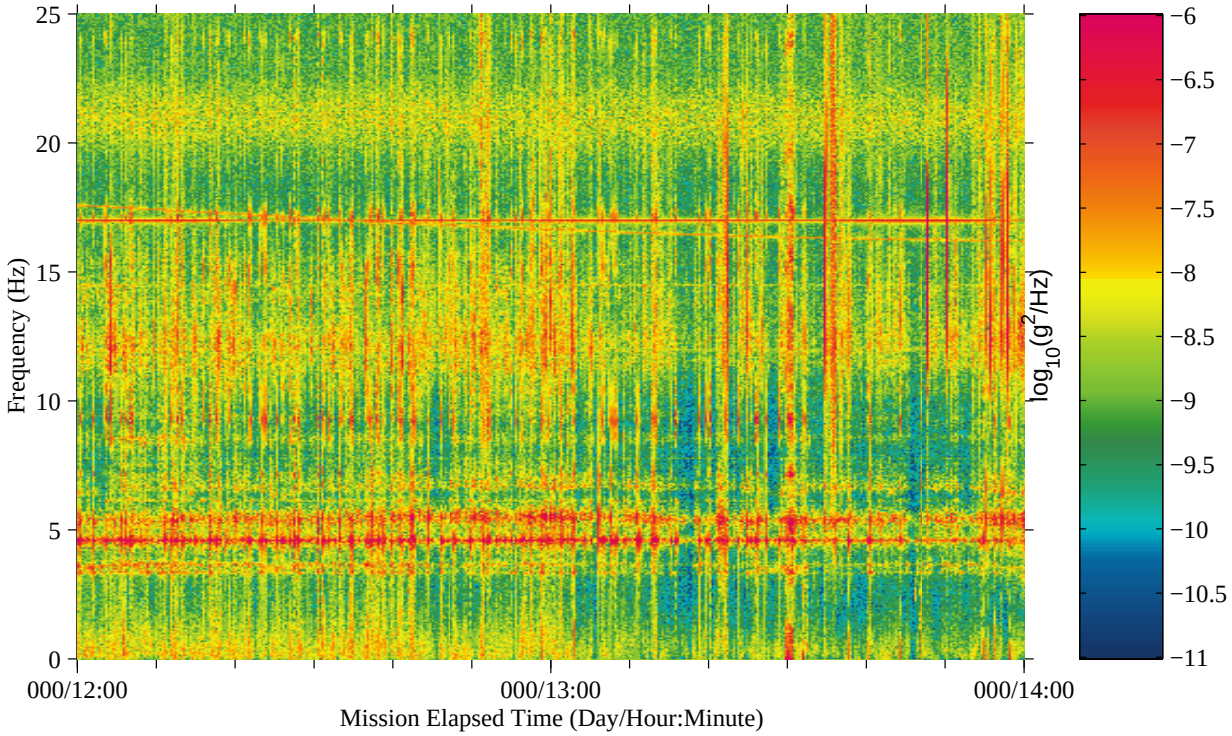

Figure 5: USML−1, Head C (fc=25 Hz)

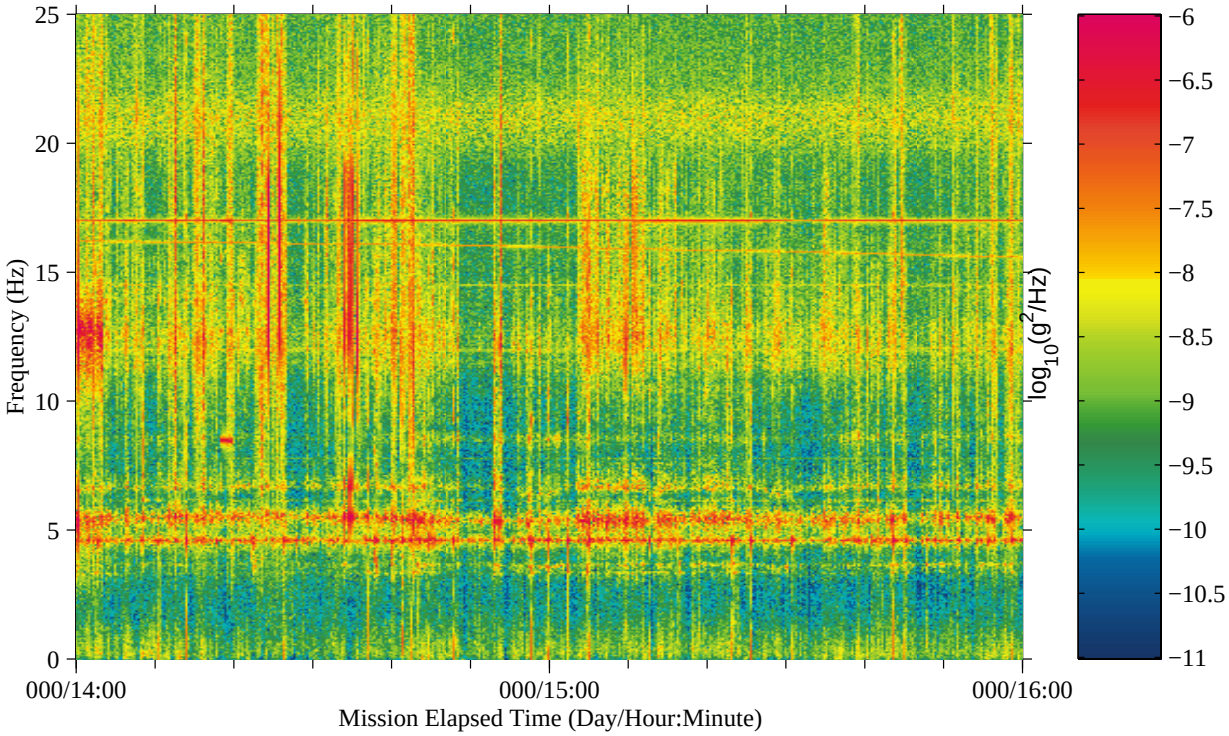

Figure 6: USML−1, Head C (fc=25 Hz)

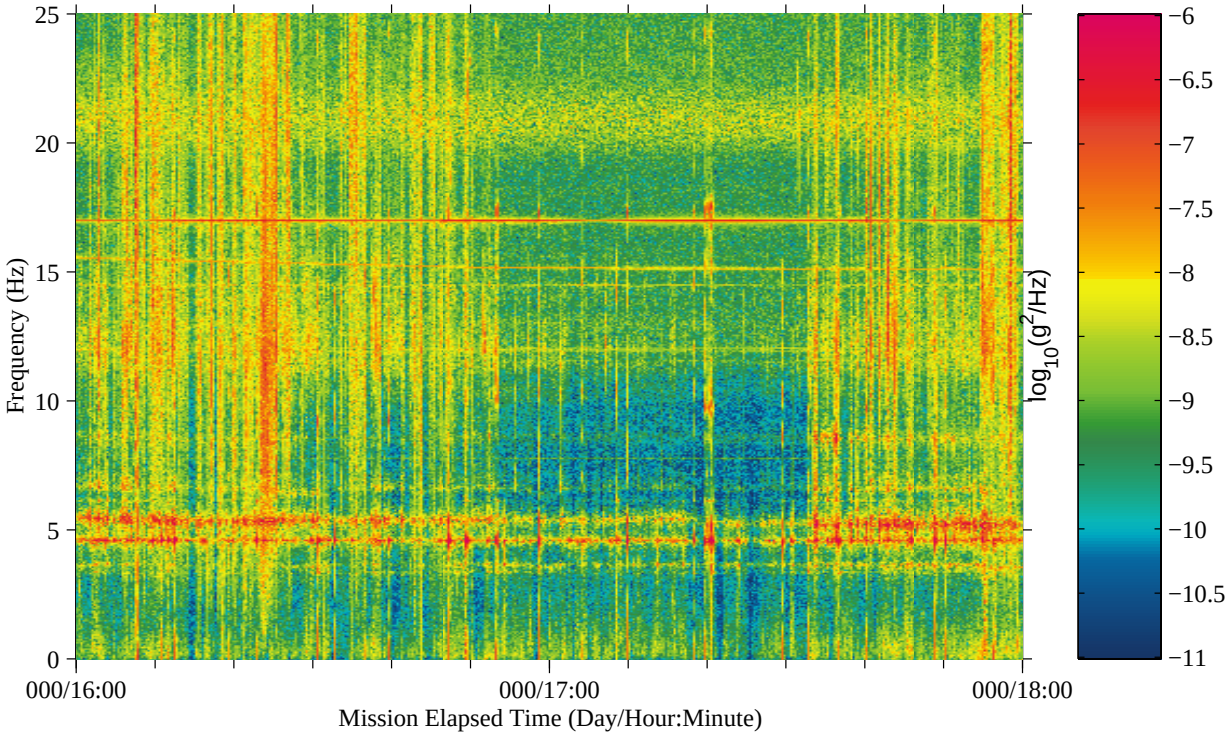

Figure 7: USML−1, Head C (fc=25 Hz)

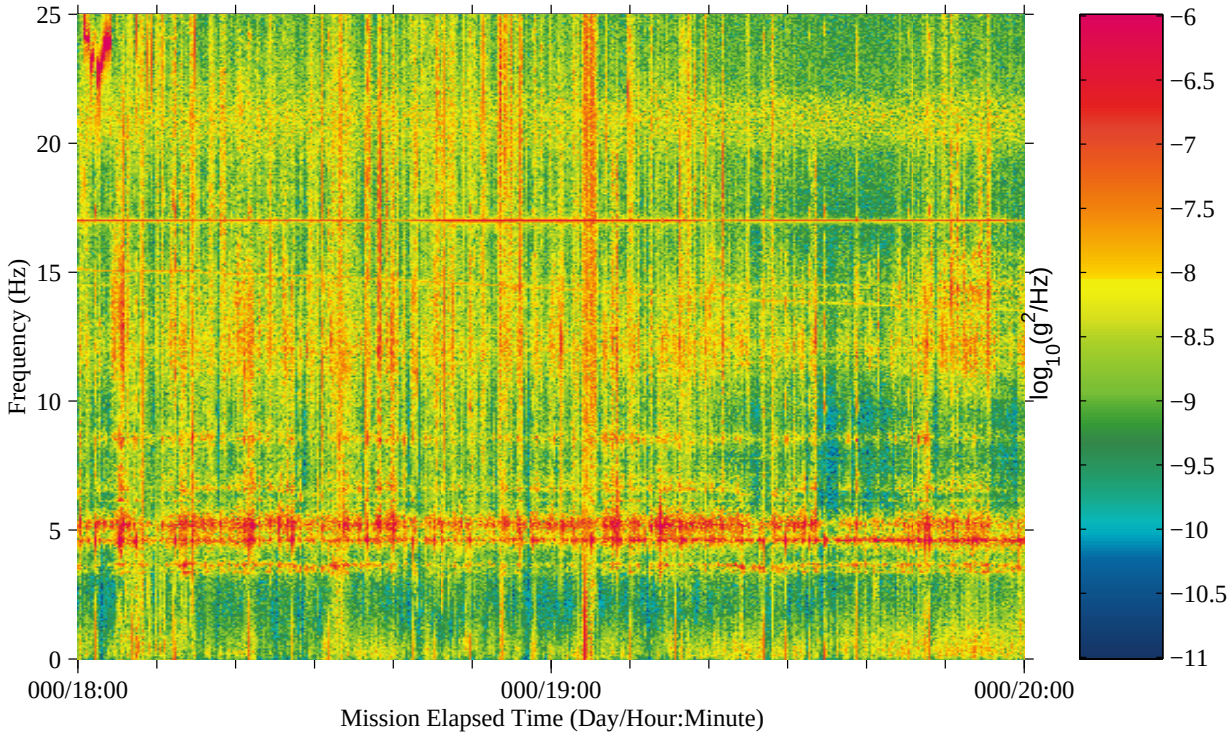

Figure 8: USML−1, Head C (fc=25 Hz)

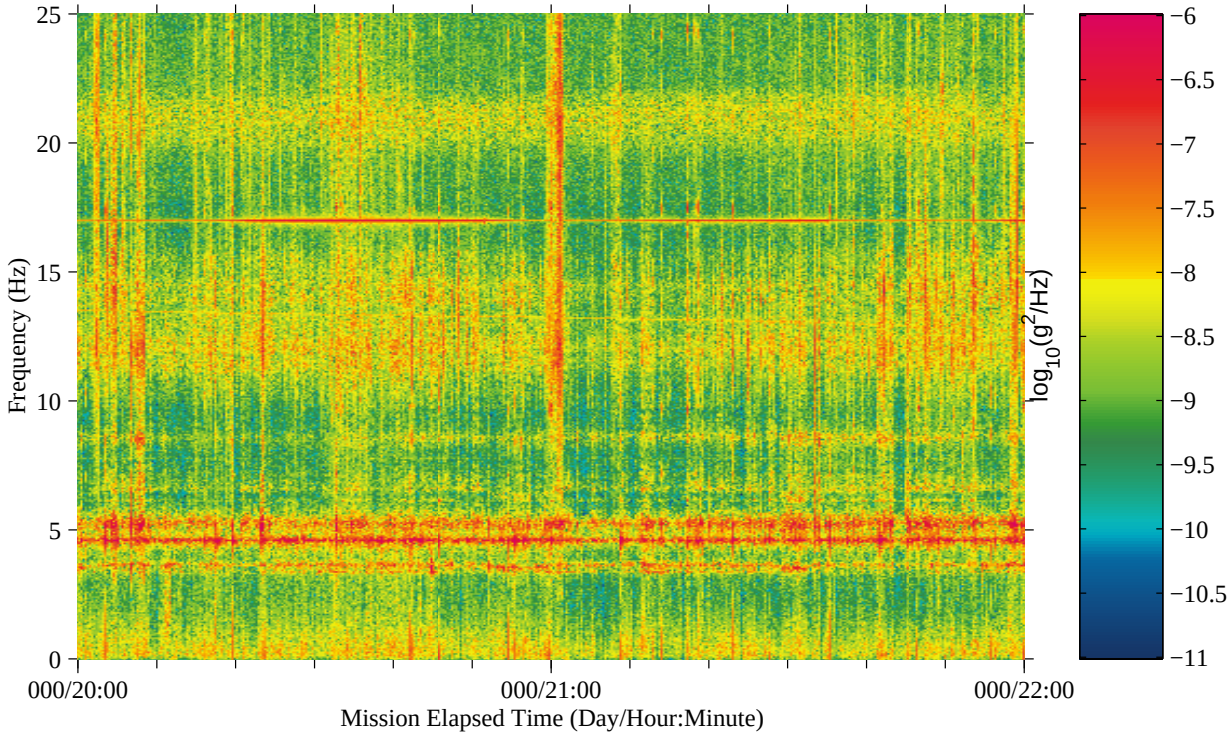

Figure 9: USML−1, Head C (fc=25 Hz)

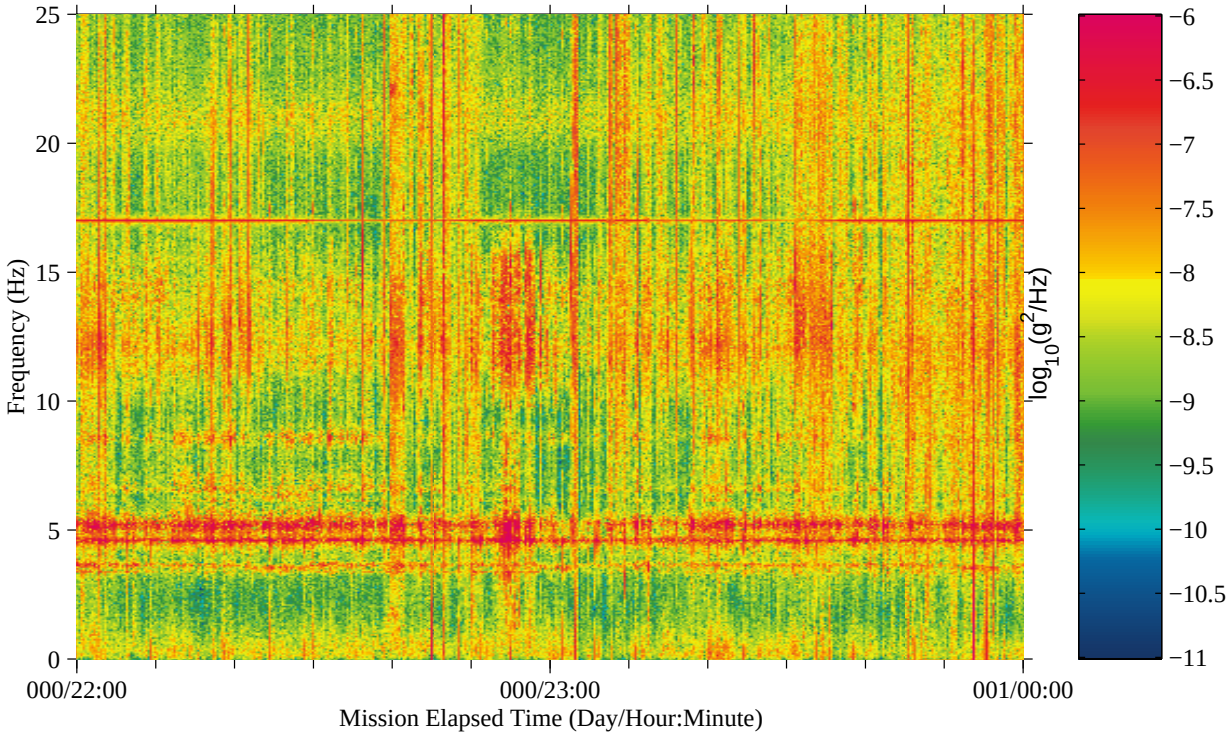

Figure 10: USML−1, Head C (fc=25 Hz)

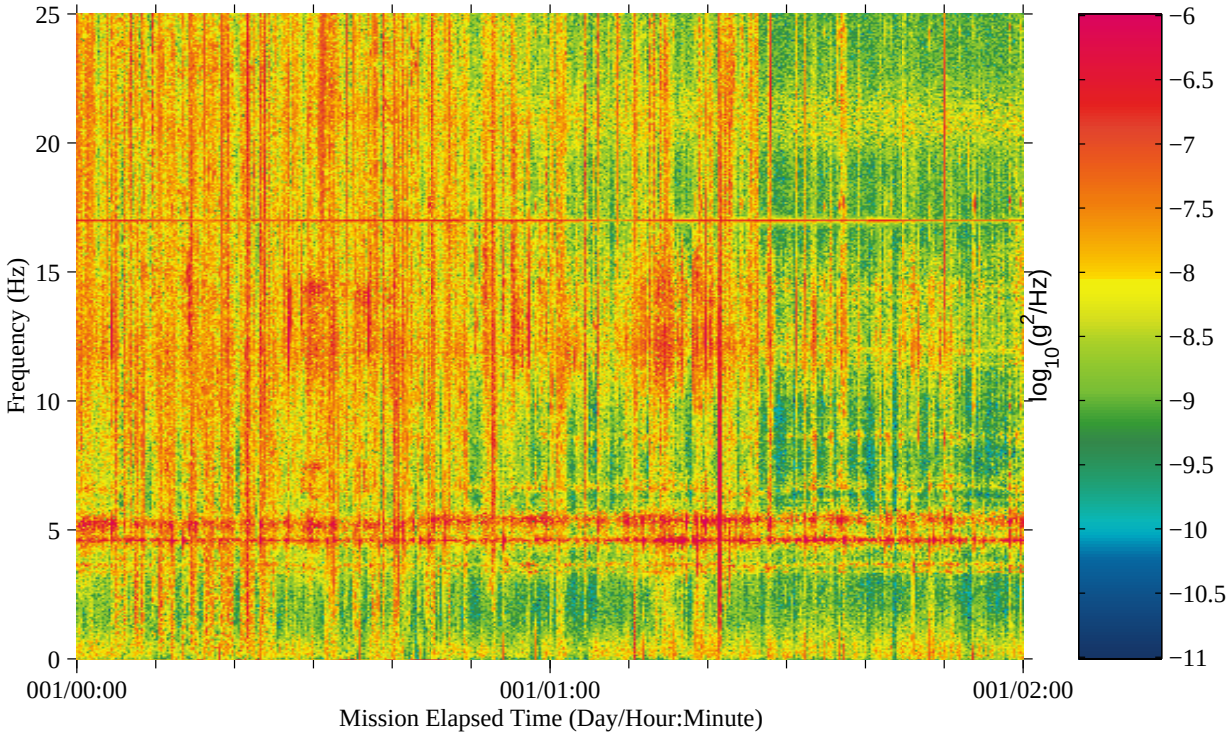

Figure 11: USML−1, Head C (fc=25 Hz)

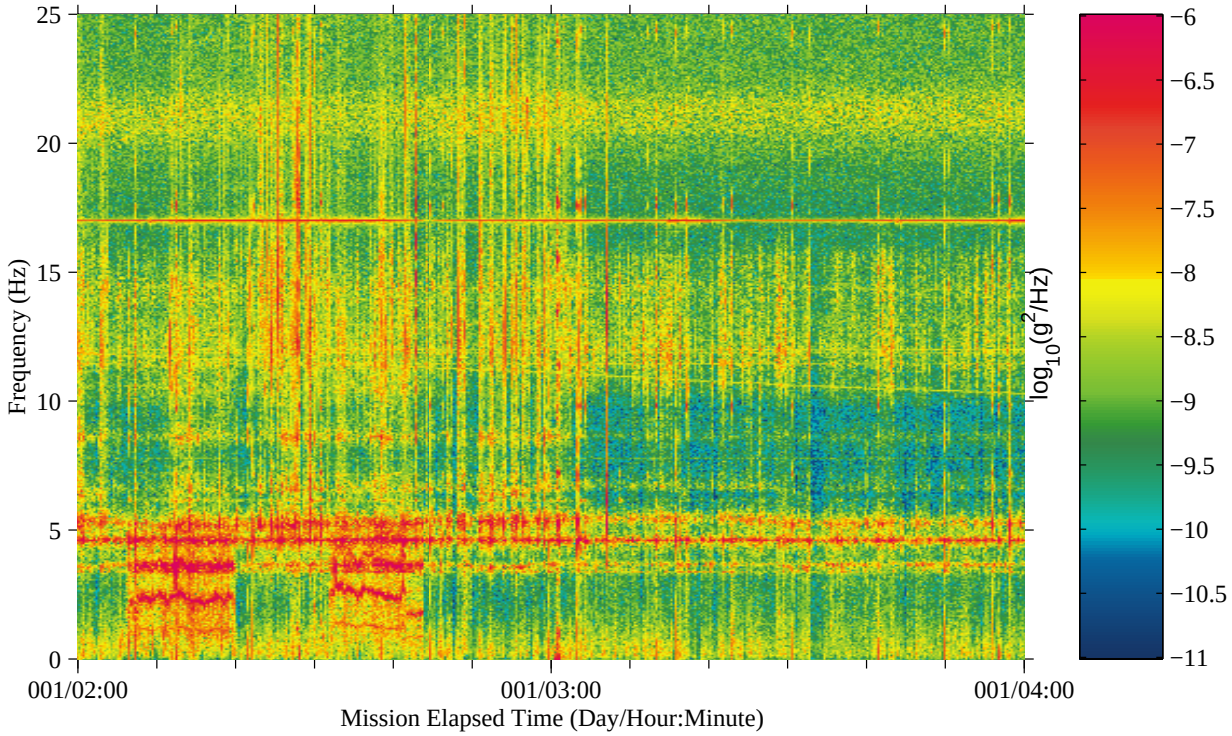

Figure 12: USML−1, Head C (fc=25 Hz)

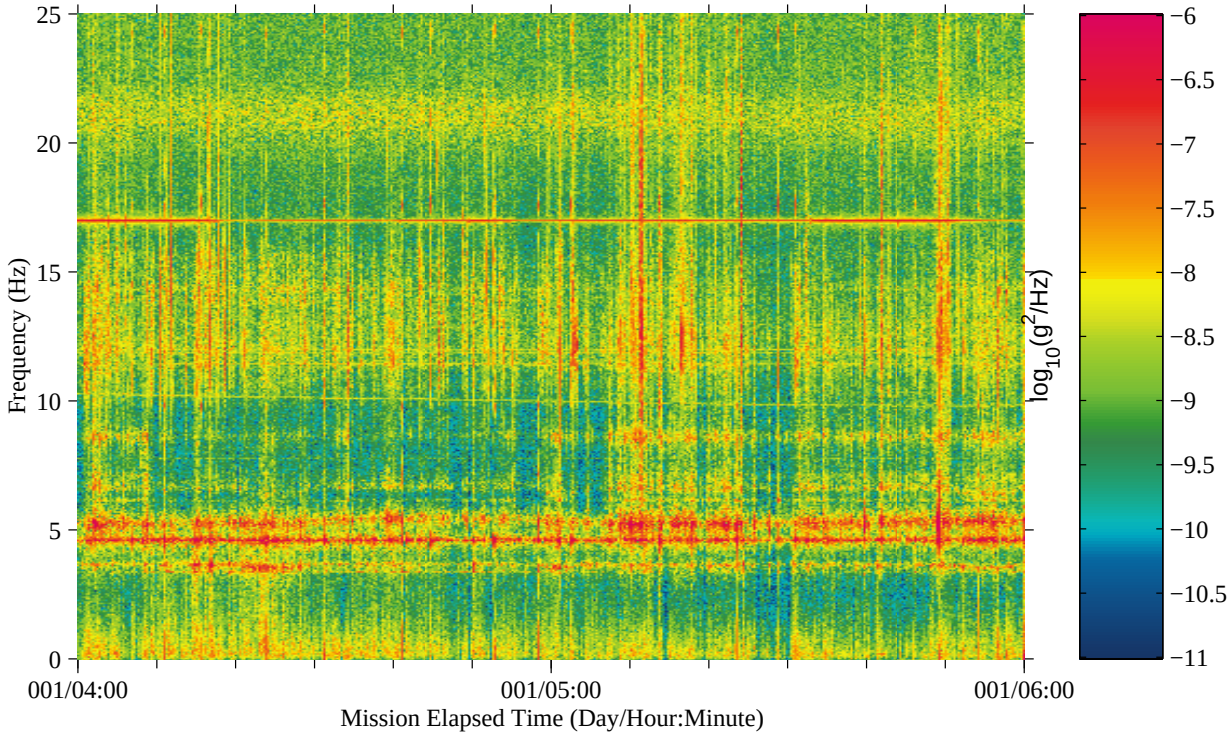

Figure 13: USML−1, Head C (fc=25 Hz)

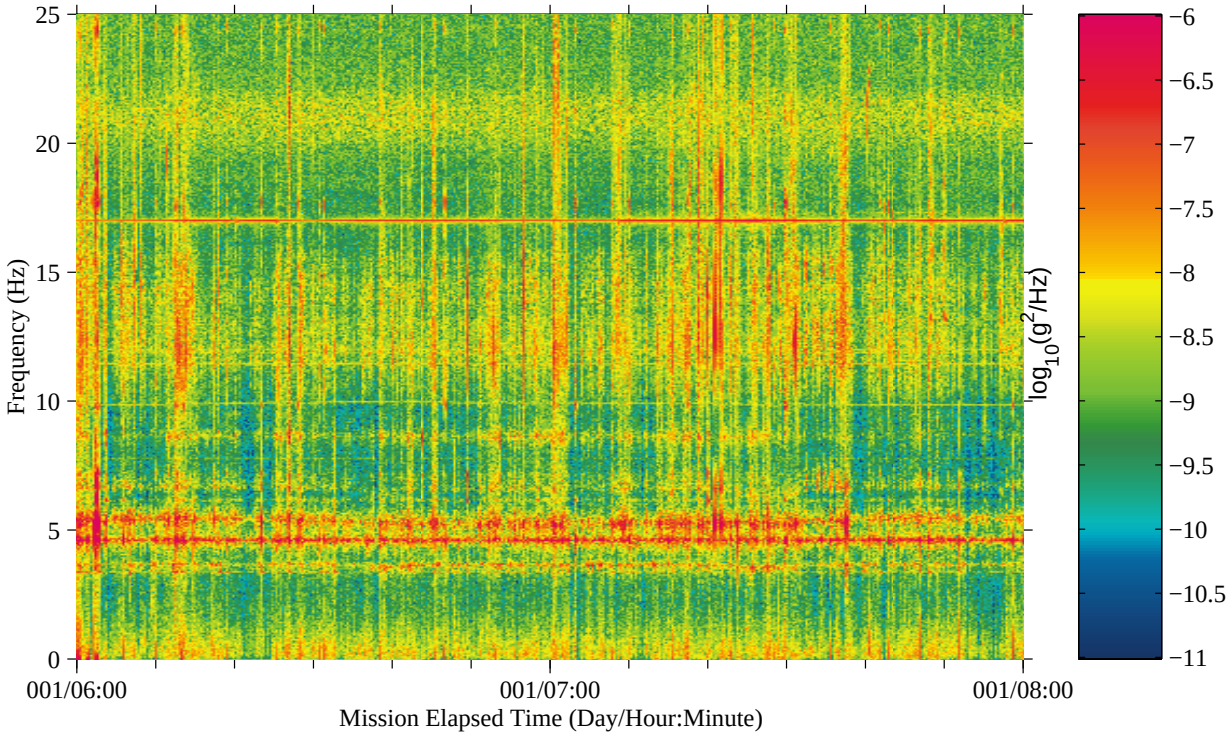

Figure 14: USML−1, Head C (fc=25 Hz)

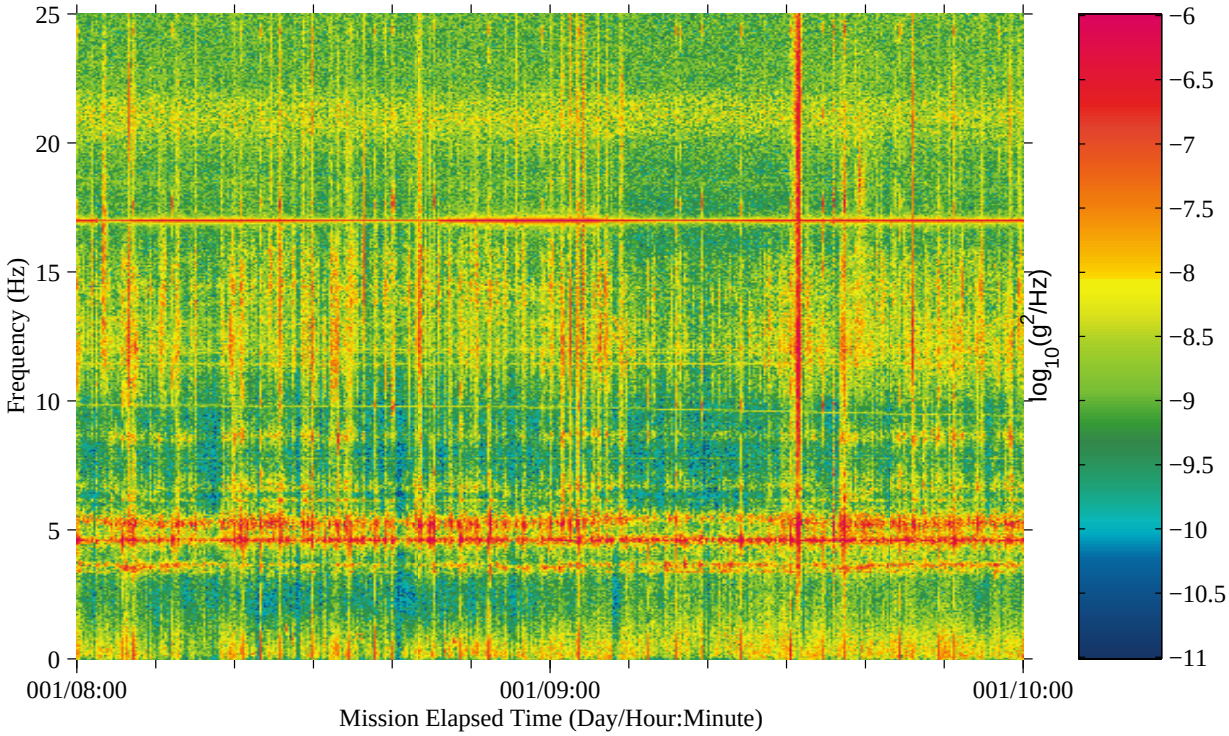

Figure 15: USML−1, Head C (fc=25 Hz)

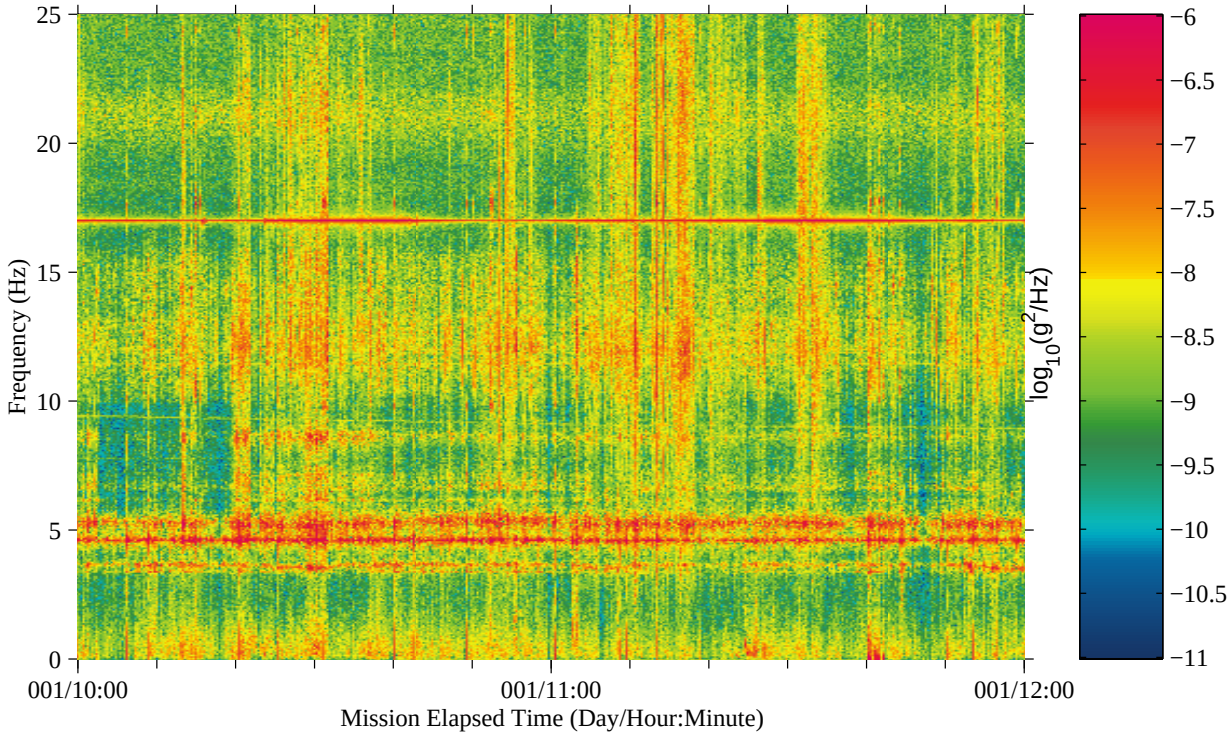

Figure 16: USML−1, Head C (fc=25 Hz)

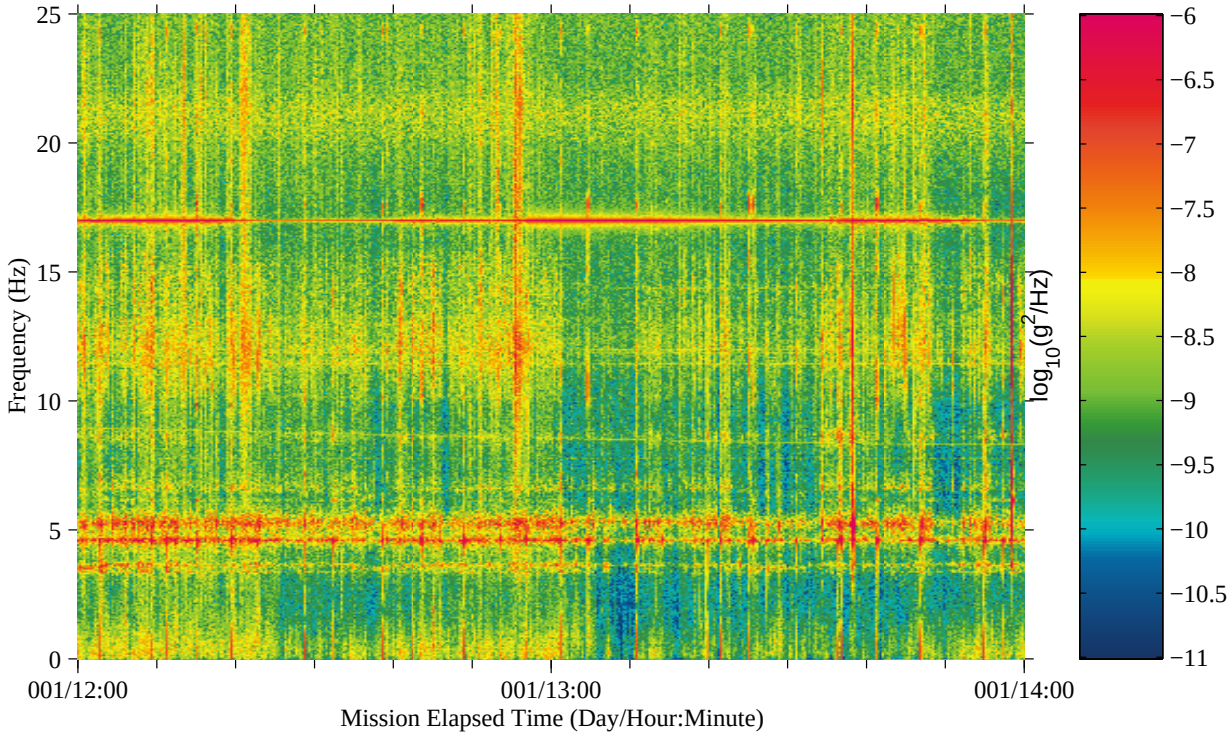

Figure 17: USML−1, Head C (fc=25 Hz)

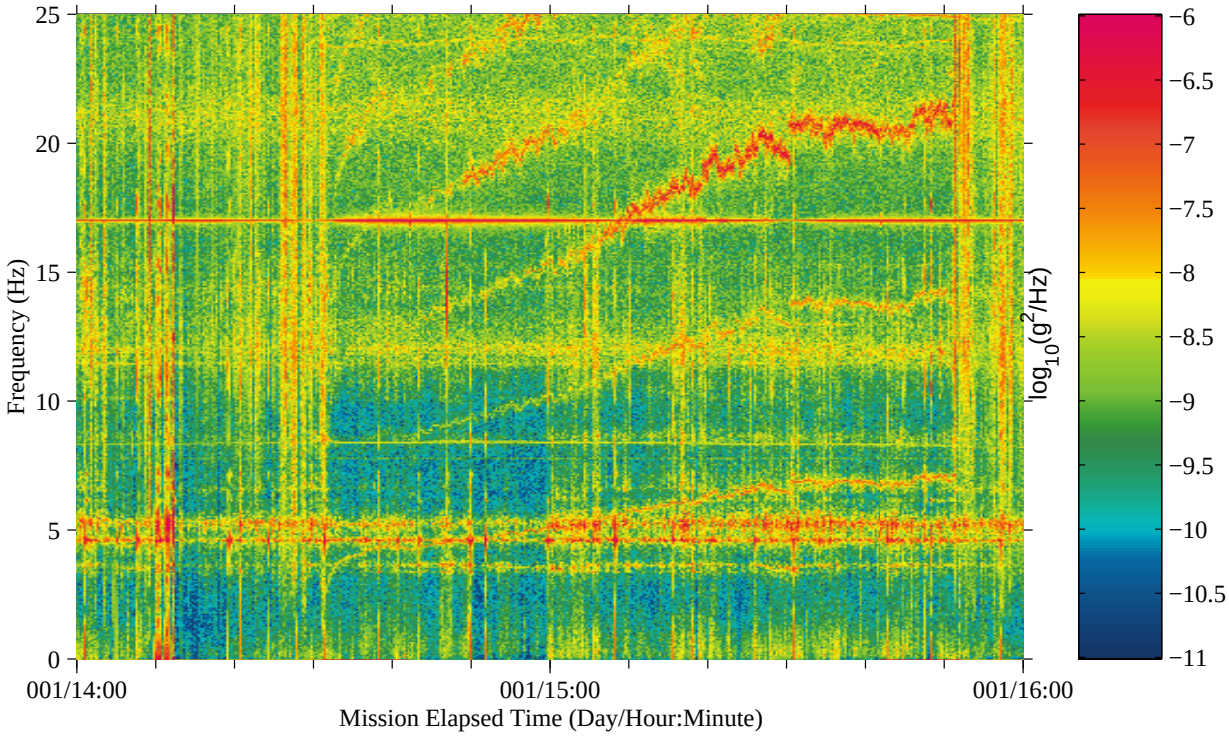

Figure 18: USML−1, Head C (fc=25 Hz)

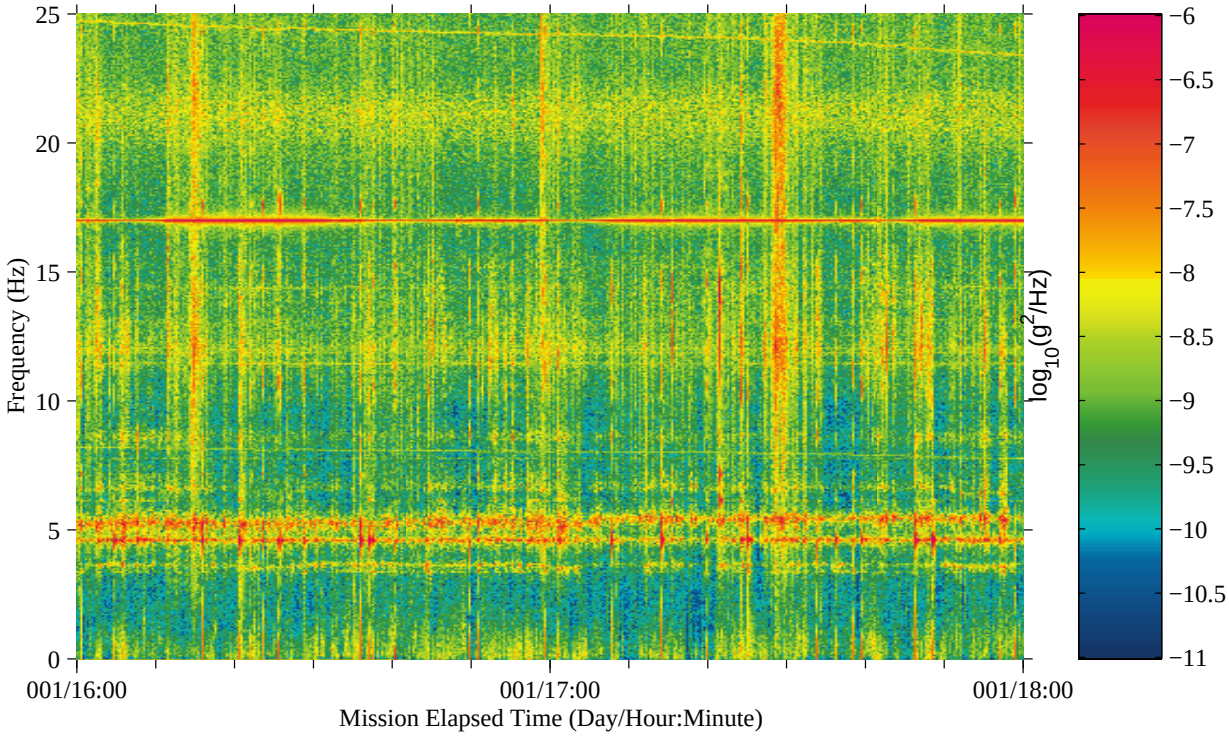

Figure 19: USML−1, Head C (fc=25 Hz)

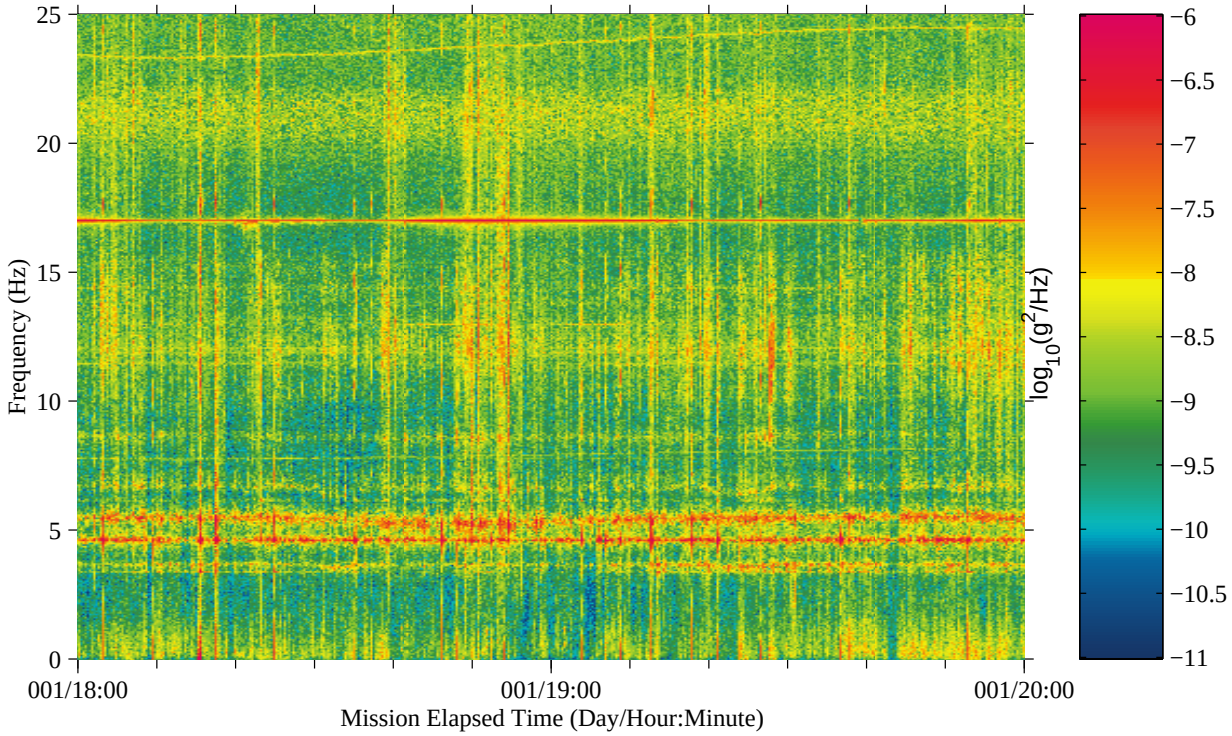
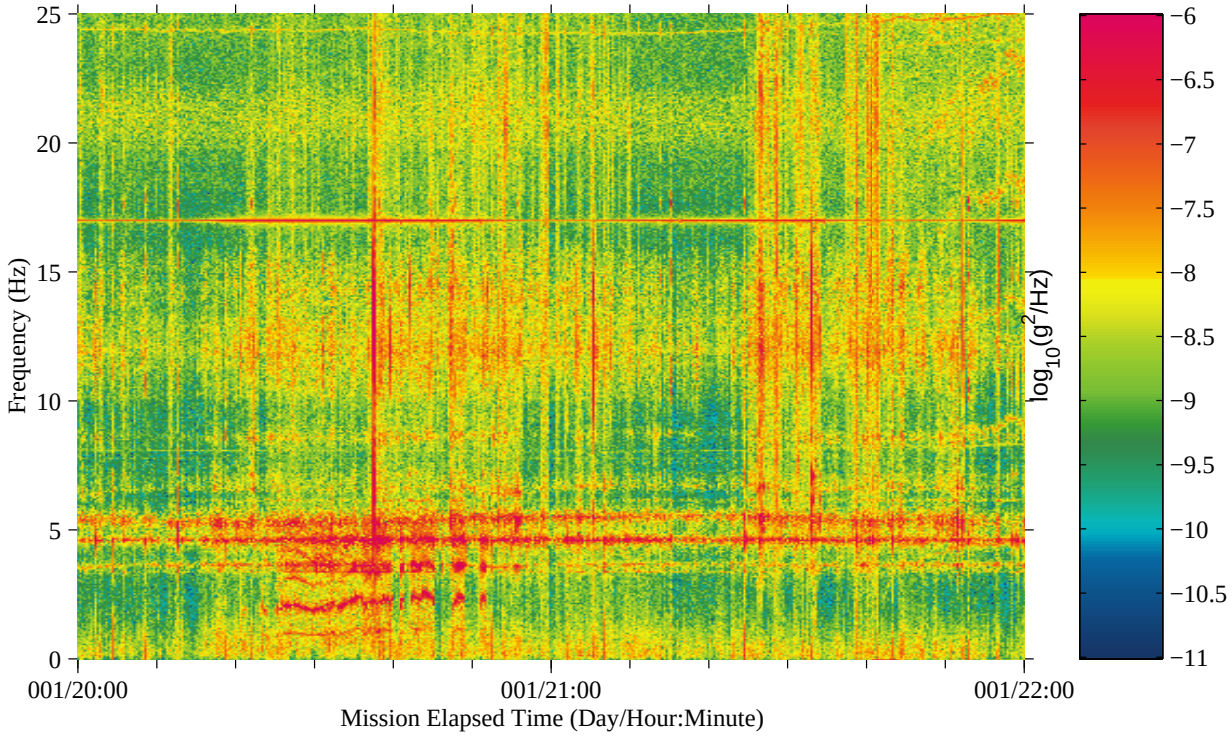
Figure 20: USML−1, Head C (fc=25 Hz)