SLAC NATIONAL ACCELERATOR LABORATORY

Metrology Department
Alignment Engineering Group
MEMORANDUM

Date: **10/04/2013**

To: Bob Law, Tor Raubenheimer

From: Georg Gassner

Subject: Background noise in Linac S2-S10

To determine the background noise in the first ten Sectors of the Linac for future installations, vibration measurements on the floor inside the Linac were taken. Four spots along the Linac in the middle of the tunnel were selected (S2-4, S4-2, S6-5 and S9-5).

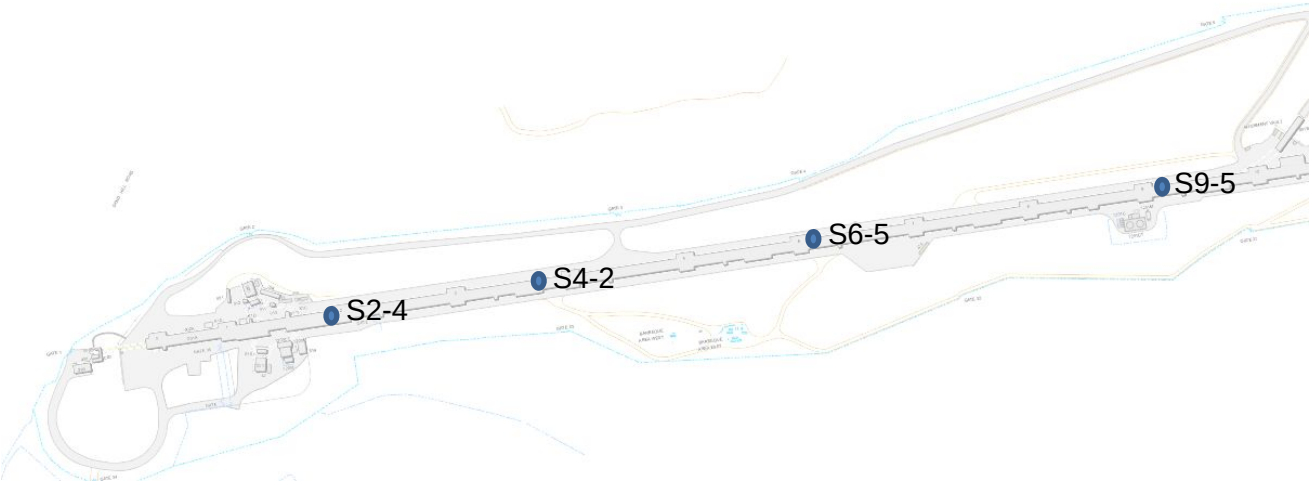


Figure 1: Map with locations of vibration measurements (blue dots).

1 Measurements

We installed three seismometers on the floor of each location (Figure 2), one vertical (y-axis) and two horizontal sensors (z- and x-axis). The sensors were aligned with the coordinate axes of the Linac. All measurements were taken with Sercel L4C sensors (sensitivity: 276.8 Volts / meter / second; Natural Freq.: 1.0 Hz). One dataset consists of 3 minutes of data sampled at 10240Hz. The data acquisition unit used was a National Instruments Model 9234 (24 Bit).

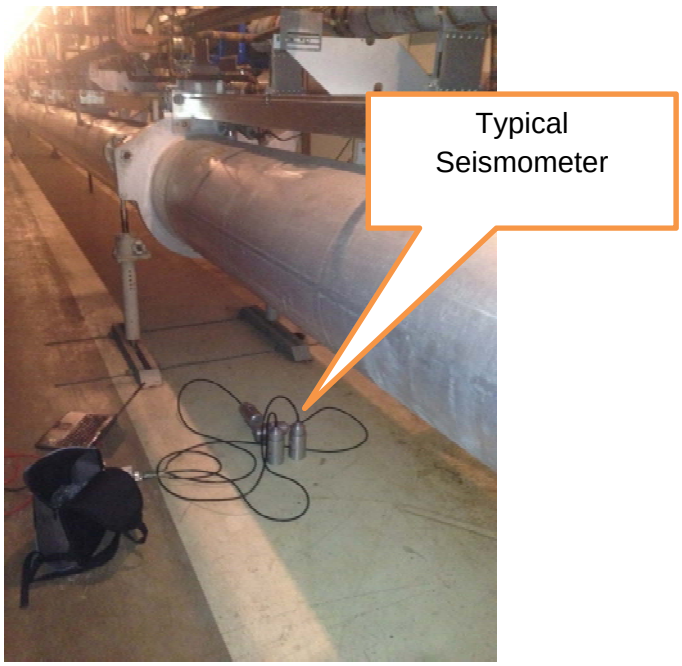


Figure 2: Seismometer setups in end station A at the end of the tunnel housing.

2 Results

2.1 Background noise

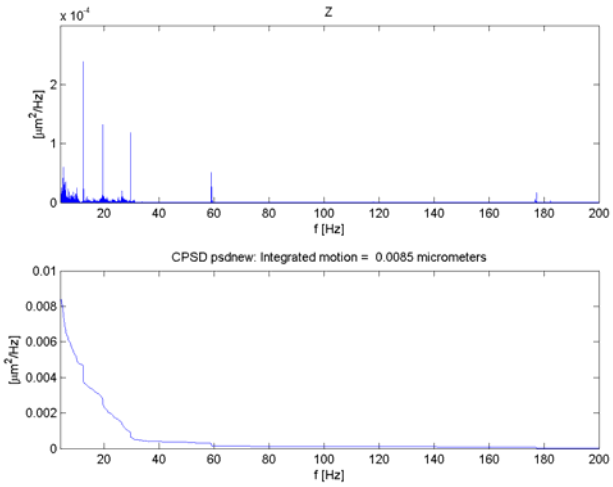
As results, the vibration RMS for a sensor between 4 and 200Hz is given, see Table 1. A graphical representation of the Power Spectrum Density (PSD) is given in Figure 3 to Figure 5. The main frequency detectable was different for different locations. The dominant frequencies at S2-4 are 9Hz and 59Hz, at S4-2 it is mainly 9Hz, at S6-5 it is mainly 59Hz and at S9-5 it is mainly 30Hz

Table 1: Background noise RMS between 4Hz and 200Hz.

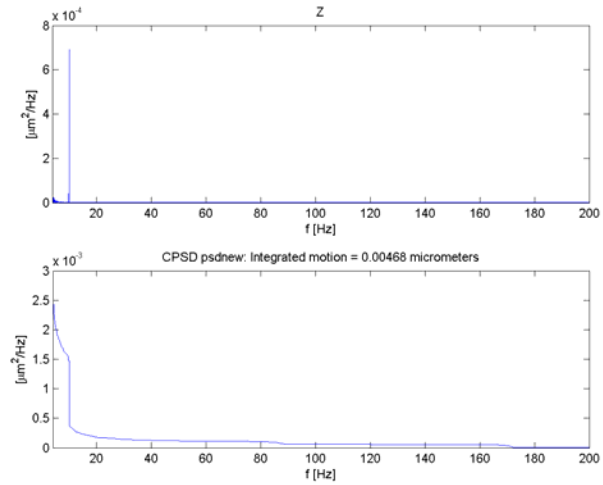
	S2-4	S4-2	S6-5	S9-5
RMS Z-axis [nm]	9	5	5	5

RMS X-axis [nm]	9	4	5	5
RMS Y-axis [nm]	9	8	5	5

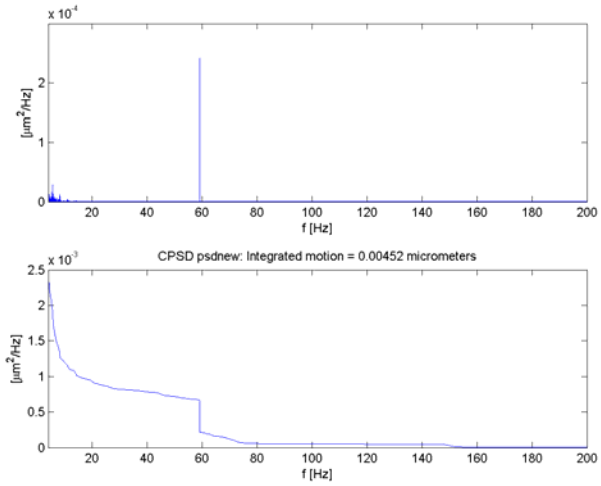
S2-4



S4-2



S6-5



S9-5

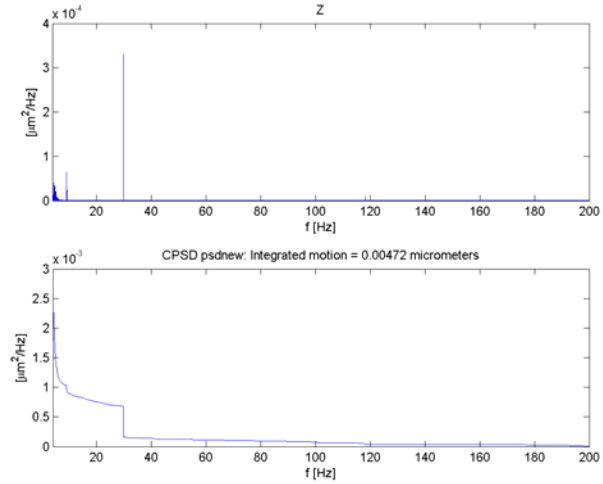
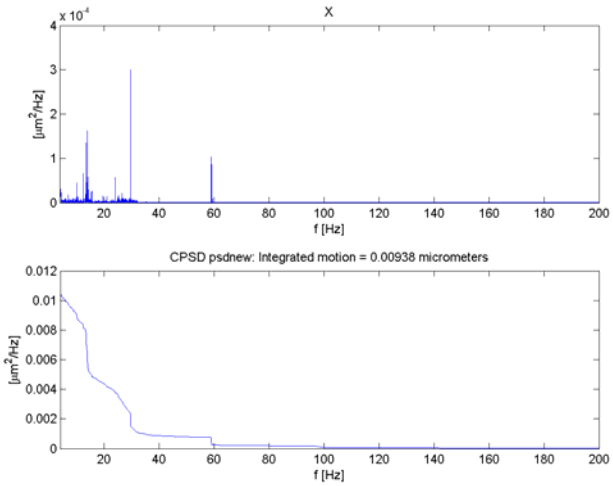
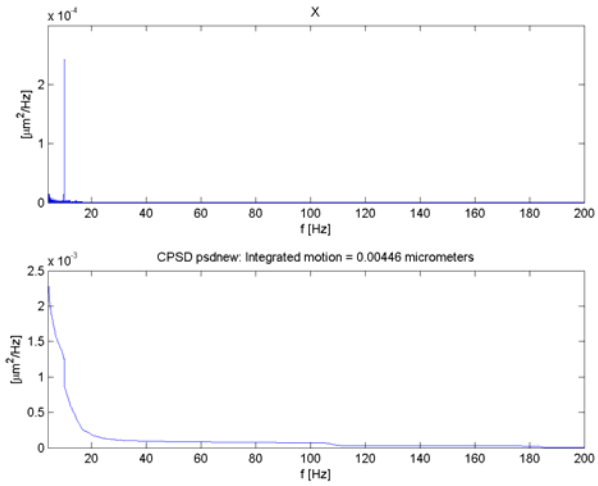


Figure 3: PSD z-axis.

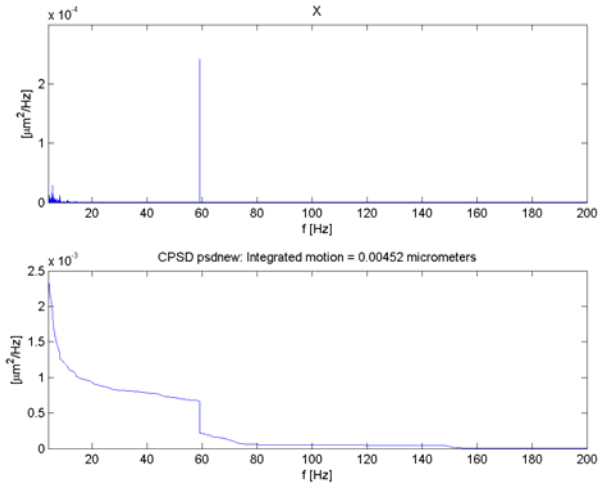
S2-4



S4-2



S6-5



S9-5

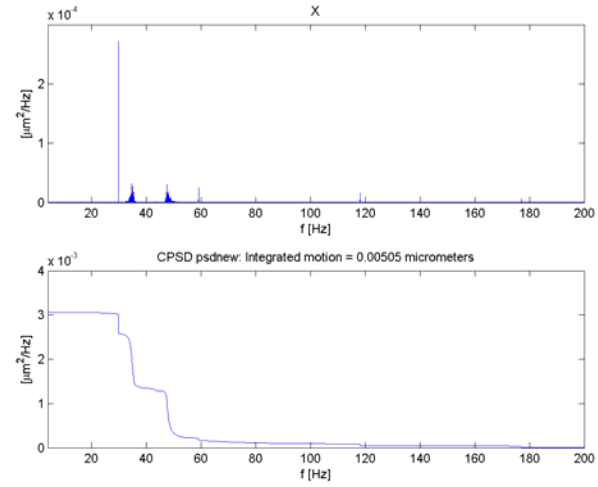
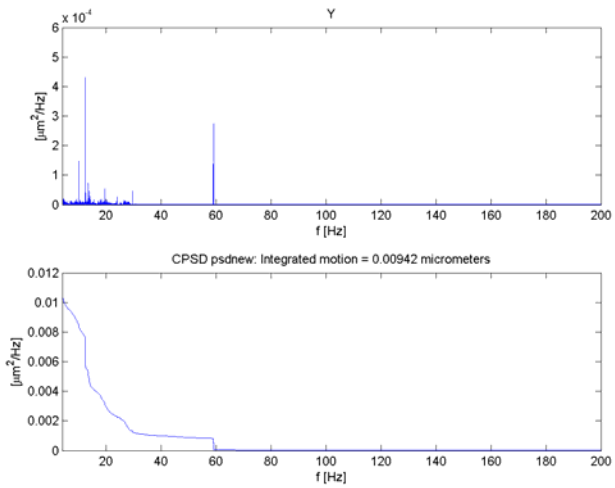
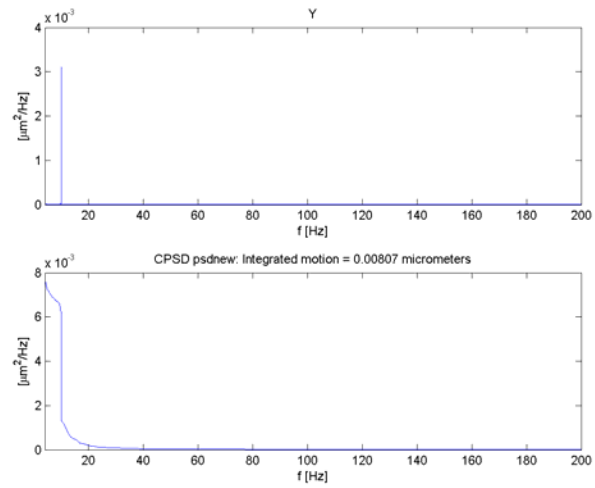


Figure 4: PSD x-axis.

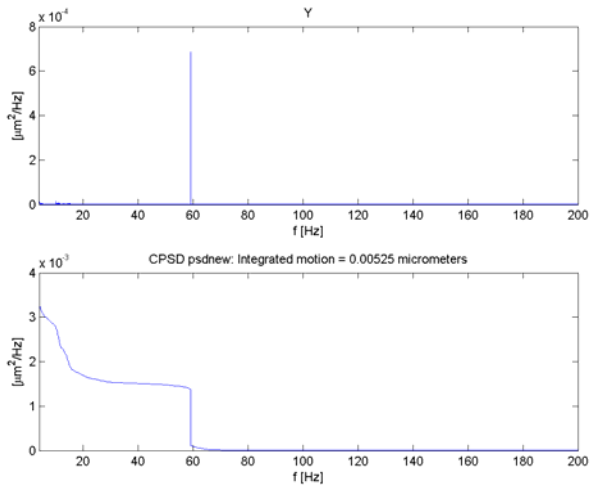
S2-4



S4-2



S6-5



S9-5

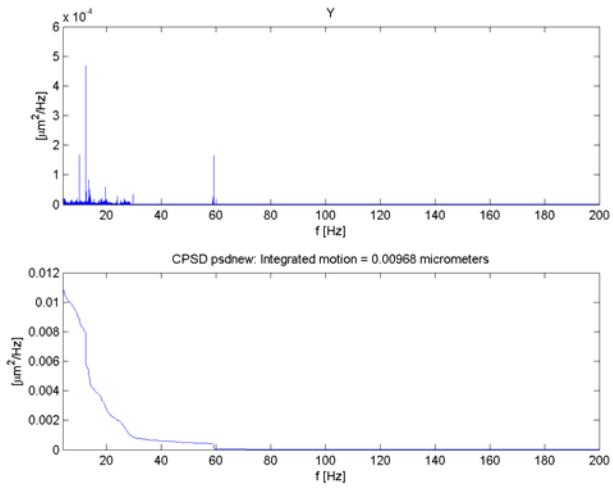


Figure 5: PSD y-axis.

3 Summary

The background noise on the floor is between 5-10nm, similar to the vibrations measured in S10-S20.