

# Vibrational Properties of Dome Tertiary-mirror Floor (Preliminary)

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Amplitude of vibration in the IR-side Tertiary-mirror Floor (TF) of the dome is measured with 3 axis acceleration sensor and compared with that of the IR-side Nasmyth Platform (NP) of the telescope.

(Only direct measurements have been done. We will try to dump the low-frequency vibration observed in TF with dumping material.)

## 1 Setup

For the TF, the vibration was measured on 2003/01/31 from 18:00 to 29:00 (HST). The 3 axis acceleration sensor was directly attached to a beam in the floor with a vice as shown in Figure 1. For the IR-side Nasmyth platform, the measurement was done on 2003/02/04 from 18:00 to 29:00 (HST). The sensor was attached to a H-beam structure of the Nasmyth platform directly with the vice.

The measured accelerations are converted into accelerations in three (vertical, centrifugal, and rotational) directions by using the angles between each sensor and gravity axis. The angles are estimated from the average output of each acceleration sensor (Figure 1). Accelerations are measured in mG (i.e.  $9.8 \times 10^{-13} \text{ m s}^{-2}$ ) unit. One measurement obtains 1024 data with 100 Hz sampling. The data sampling continued during the nights with about 10s interval.

The profiles of the telescope movements in both of the nights are shown in Figure 2.

## 2 Results

Examples of measured vibrations during auto-guiding mode on TF and NP are shown in Figure 3 and 4, respectively. In vertical and centrifugal directions, the amplitude of the vibration of TF is similar to that of NP. In rotational direction, there is low-frequency vibration on TF.

Fourier analysis results of one set of 1024 data are shown in Figure 5 (Left TF, Right NP). The results indicate that there are a peak at 13Hz and 4Hz vibration in TF and NP dataset, respectively. (The peak frequency of TF did not change during night, but that of NP changed from 3Hz to 5Hz.)

The power-spectrum of TF (solid) and NP (dotted) vibrations are directly compared in Figure 6. Power-spectrum of TF vibrations in vertical and centrifugal directions are similar to those of NP except for the peak. In rotational direction, in frequency range above 3Hz, the power-spectrum of TF is similar to that of NP. In frequency range below 3Hz, there is an excess of power in TF vibration in rotational direction. (One NP power-spectrum shows excess below 3Hz. The excess caused by a telescope quick movement (dithering?) during the sample.) The

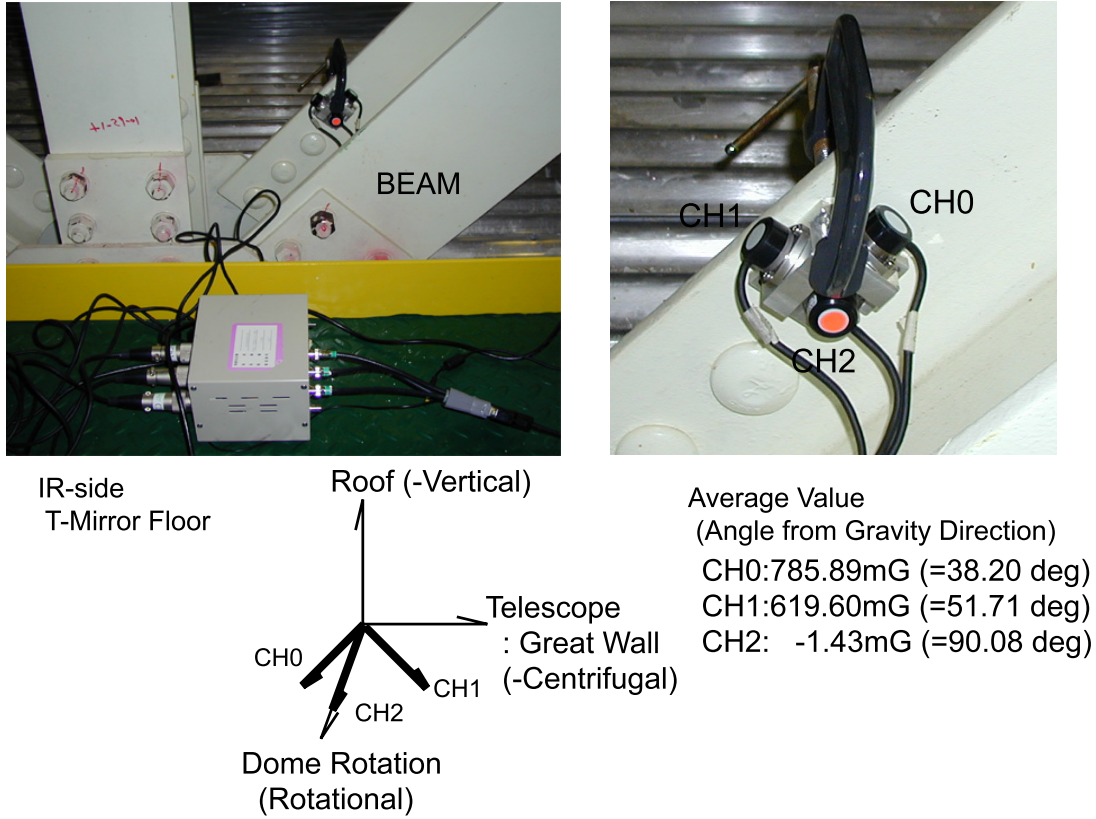


Figure 1: The setting of the dome vibration measurement. The angle between the axis of each sensor and the gravity axis is calculated with the average acceleration of each sensor.

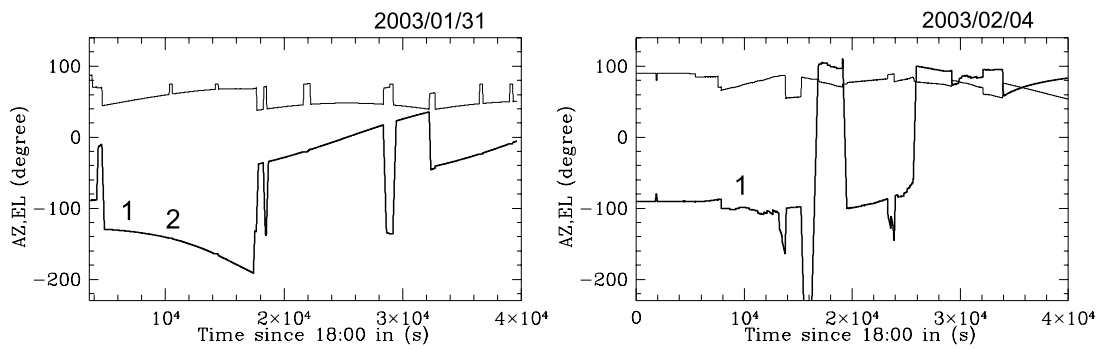


Figure 2: Profiles of azimuth (thick) and elevation (thin) angles of the telescope in the nights of the vibration measurements. The vibration profiles shown in the following figures are taken at the times indicated with numbers.

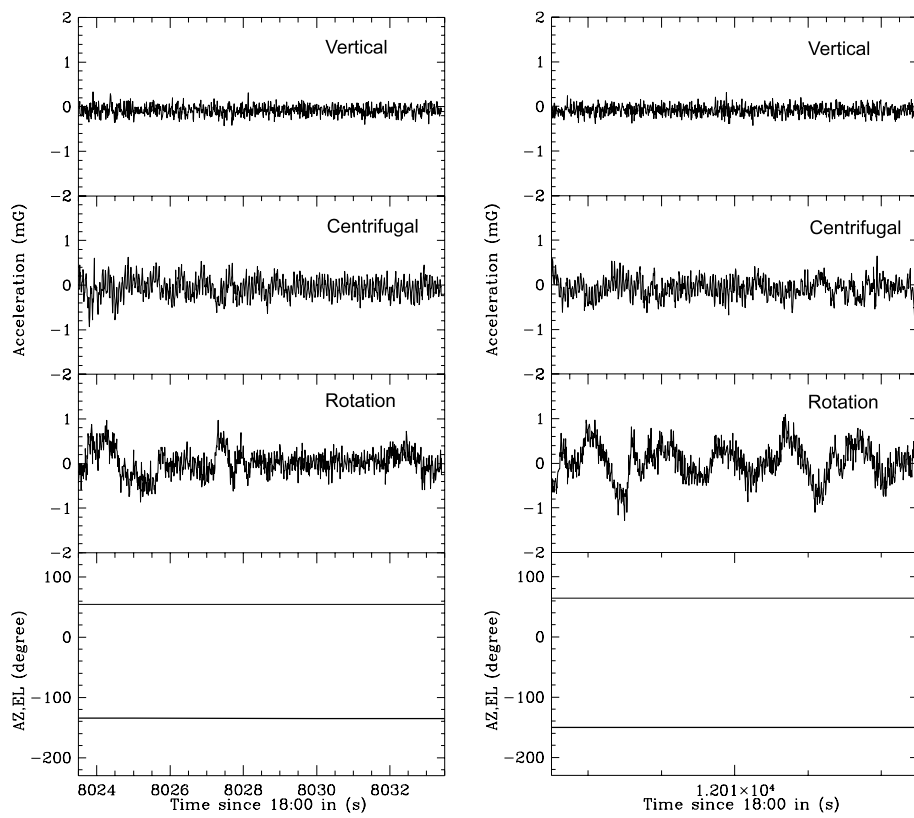


Figure 3: Example of measured vibration profiles of TF during auto-guiding mode. Time 1 (left) and 2 (right) in Figure 2.

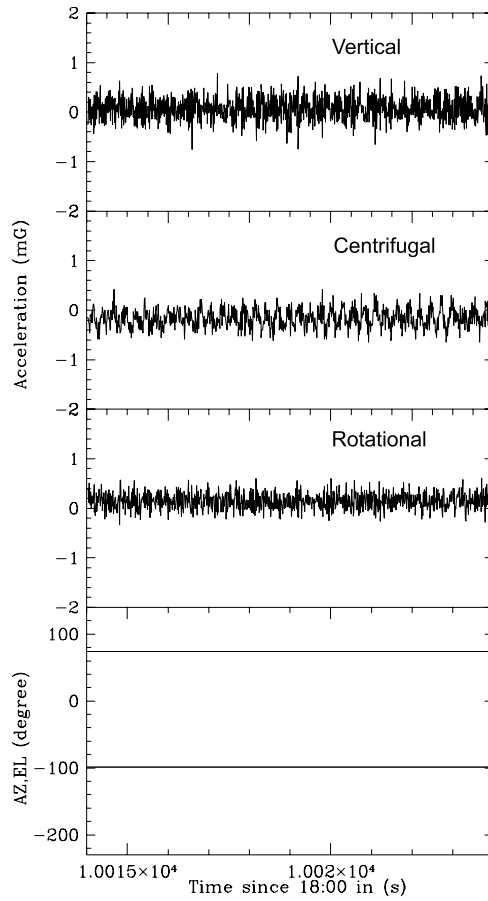


Figure 4: Example of measured profile of vibration of NP during auto-guiding mode. Time 1 in Figure 2.

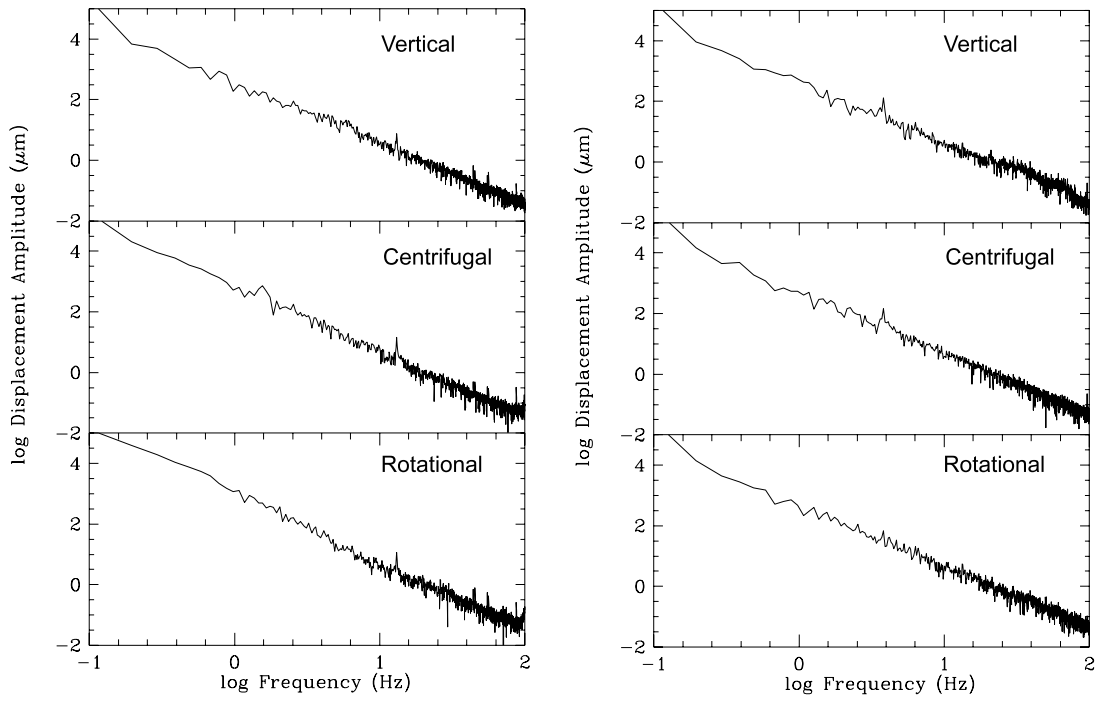


Figure 5: Example of power-spectrum of TF and NP vibrations during auto-guiding mode.

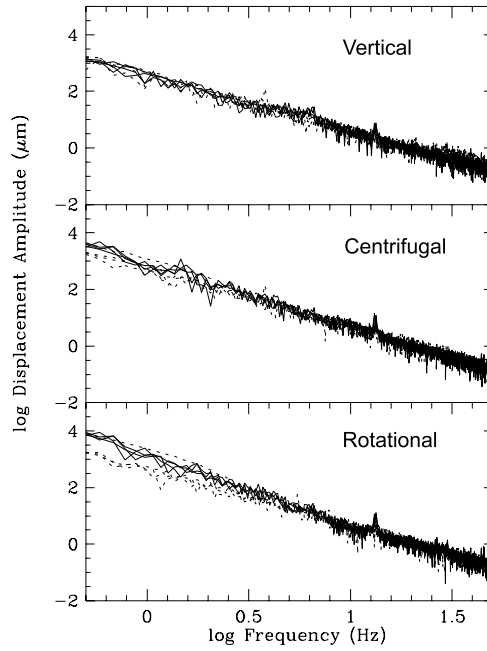


Figure 6: Comparison between power-spectrum of TF (solid) and NP (dotted) vibrations during auto-guiding mode. Four results are shown for each place.

power-spectrum comparison is consistent with the difference of TF and NP vibration profile shown in Figure 3 and 4.

### **3 Next Step**

We need to examine how the low-frequency vibration in TF rotational direction can be reduced with dumping material, like rubber sheet.