Vibration measurement of FFTB movers

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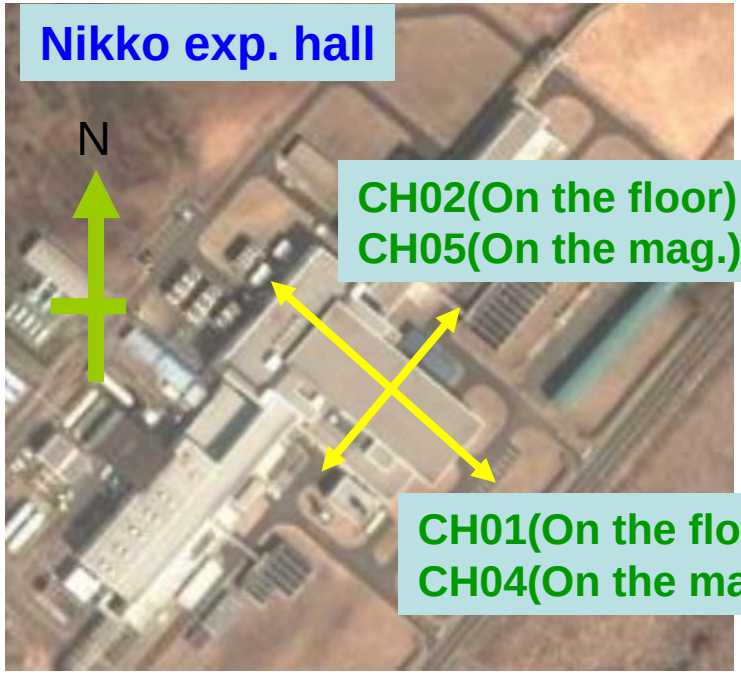
Ryuhei Sugahara

Contents

Introduction



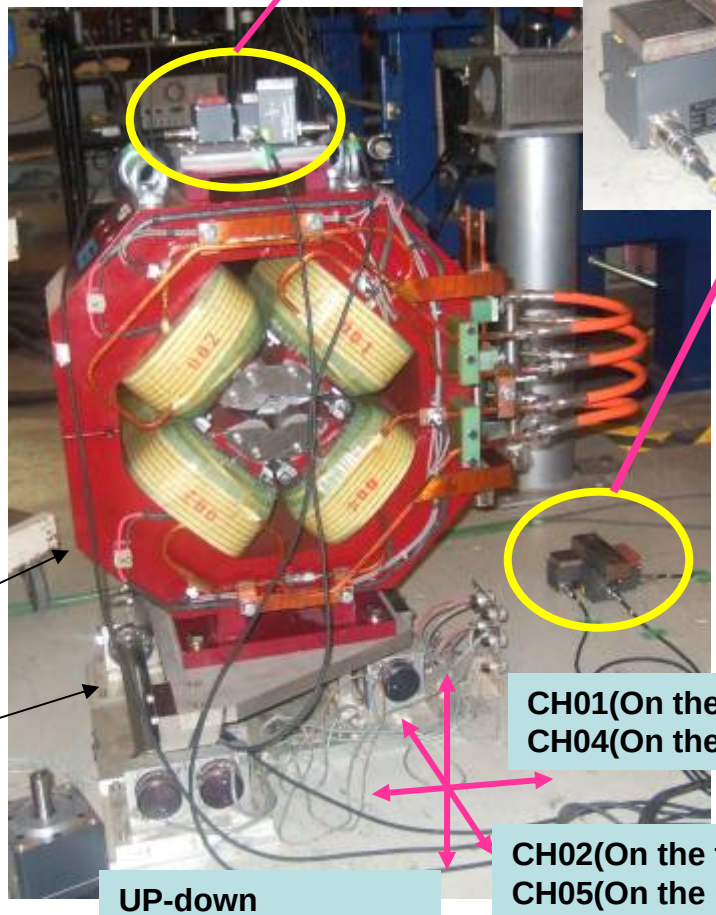
UP-down
CH03(On the floor)
CH06(On the mag.)

QEA magnet(~300kg)

SLAC cam mover

Accelerometer

Accelerometer



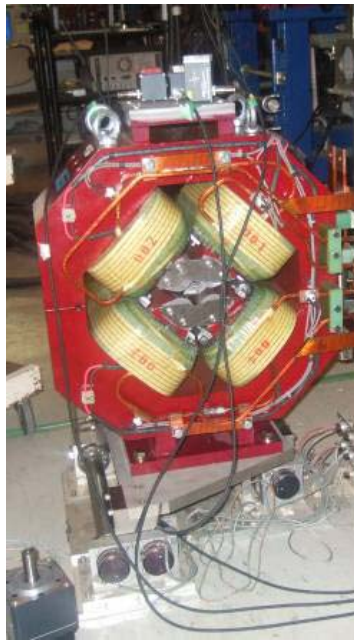
CH01(On the floor)
CH04(On the mag.)

CH02(On the floor)
CH05(On the mag.)

UP-down
CH03(On the floor)
CH06(On the mag.)

Servo Accelerometer MG－１０２	Tokkyokiki Corp.
Size	40×40×50mm
Max. input	±２G
Resolution	１／10^6G

Acc. 0.1～400Hz
Acc. 60dB = 1gal/V



Measurements

Freq range=100Hz; T=5min

1. The QEA magnet is mounted on the mover

(1.1) Sensor #1-3=on the floor
Sensor #4-6=on the magnet

(1.2) Excitation by stepping motor
Sensor #1-3=on the floor
Sensor #4-6=on the magnet

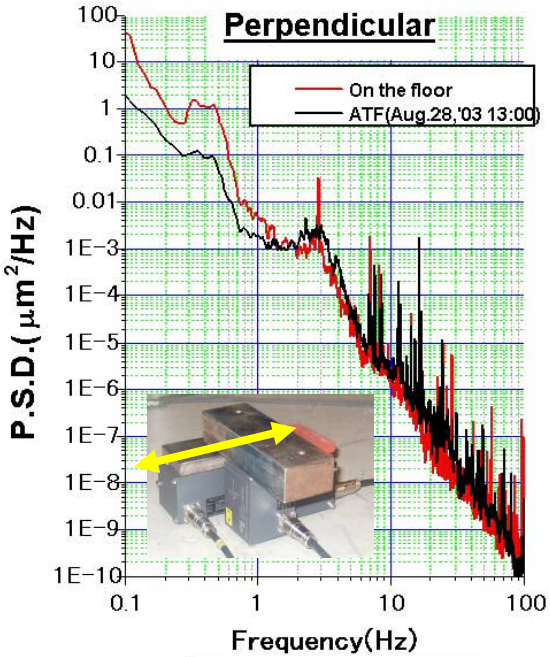
(1.3) Sensor #1-3=on the floor
Sensor #4-6=on the mover

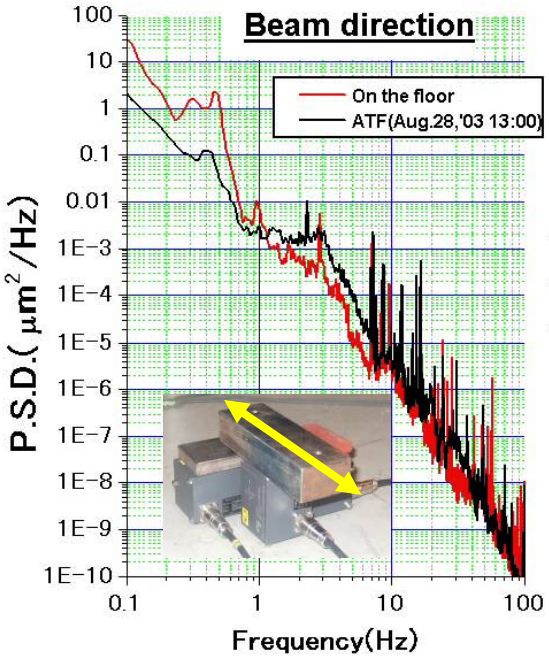
(1.4) Excitation by stepping motor
Sensor #1-3=on the floor
Sensor #4-6=on the mover

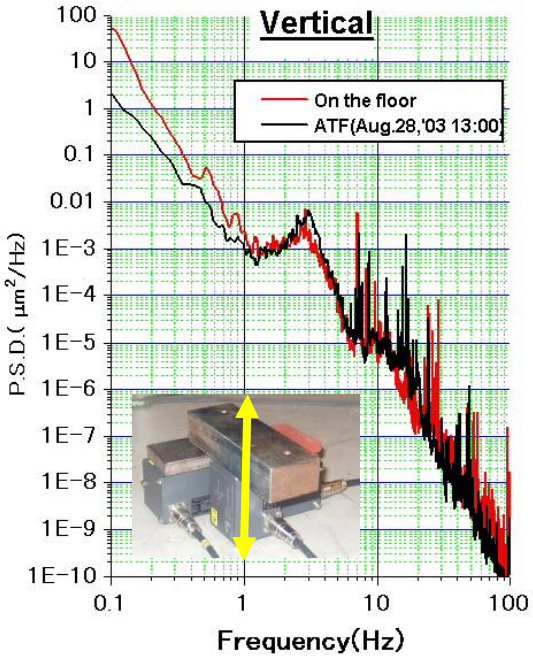
2. Un-mounting the magnet from mover.

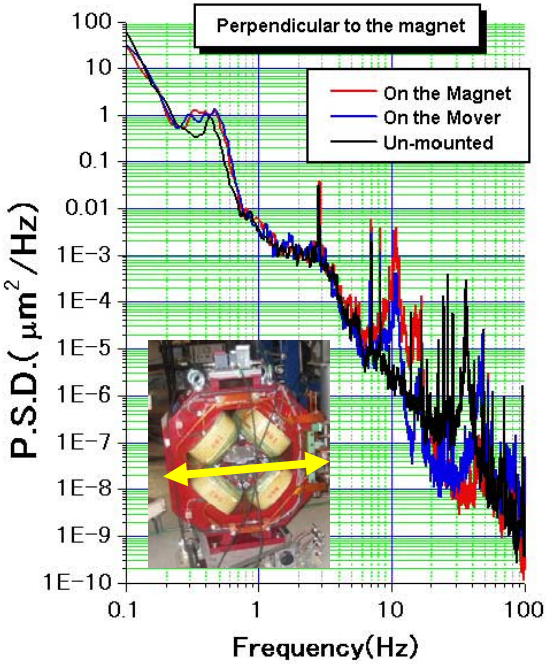
(2.1) Sensor #1-3=on the floor
Sensor #4-6=on the magnet

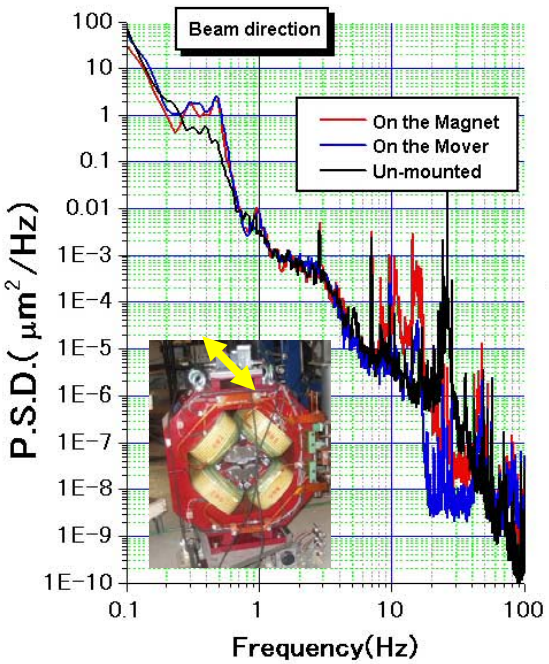
(2.2) Excitation by stepping motor
Sensor #1-3=on the floor
Sensor #4-6=on the magnet

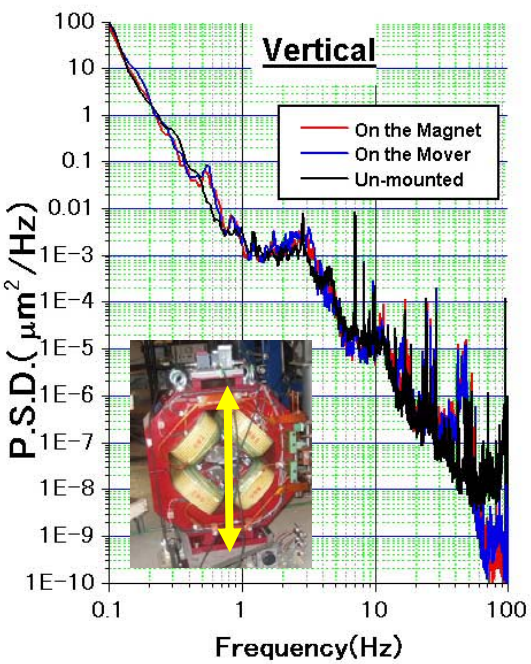

Perpendicular
On the floor
ATF(Aug.28,'03 13:00)
P.S.D.(μm²/Hz)
Frequency(Hz)

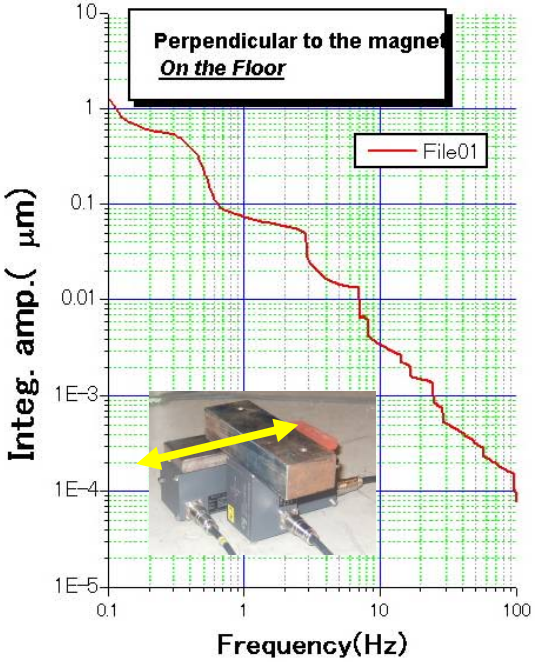

Beam direction
On the floor
ATF(Aug.28,'03 13:00)
P.S.D.(μm²/Hz)
Frequency(Hz)

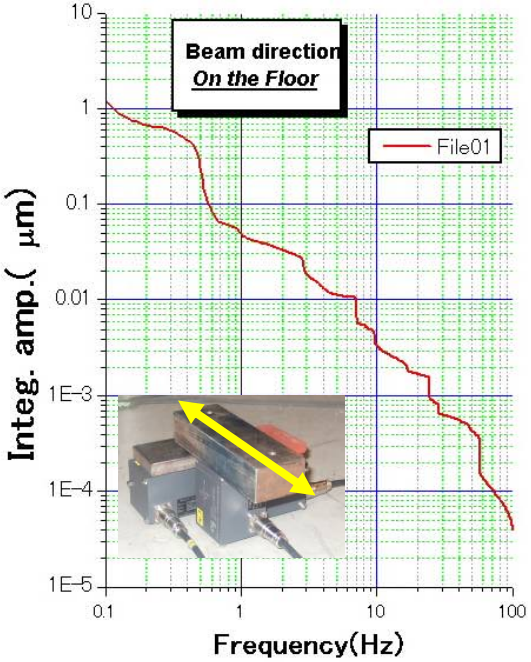

Vertical
On the floor
ATF(Aug.28,'03 13:00)
P.S.D.(μm²/Hz)
Frequency(Hz)

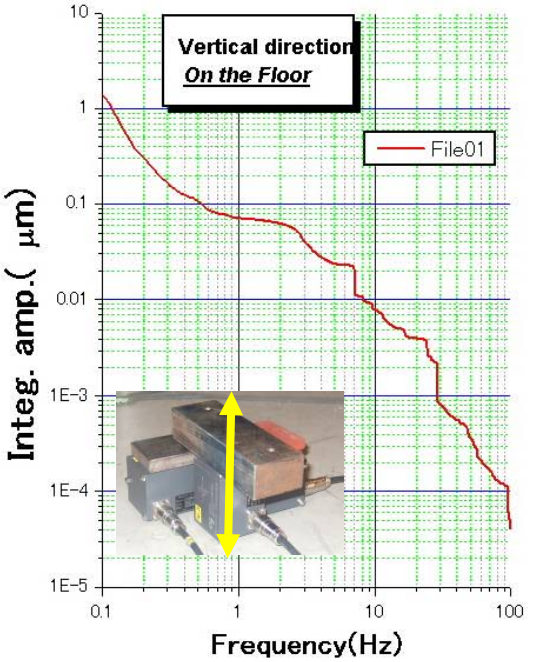

Perpendicular to the magnet
On the Magnet
On the Mover
Un-mounted
P.S.D.(μm²/Hz)
Frequency(Hz)

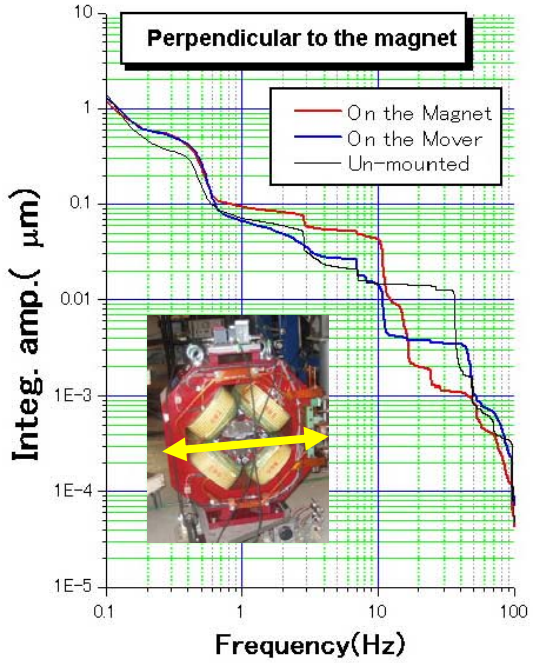

Beam direction
On the Magnet
On the Mover
Un-mounted
P.S.D.(μm²/Hz)
Frequency(Hz)

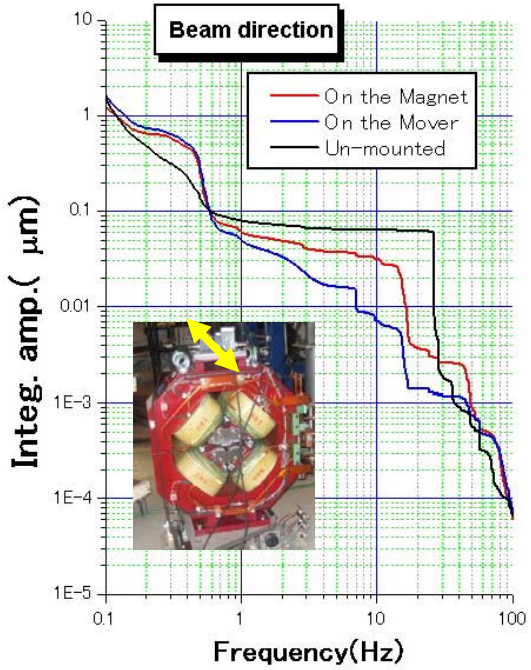

Vertical
On the Magnet
On the Mover
Un-mounted
P.S.D.(μm²/Hz)
Frequency(Hz)

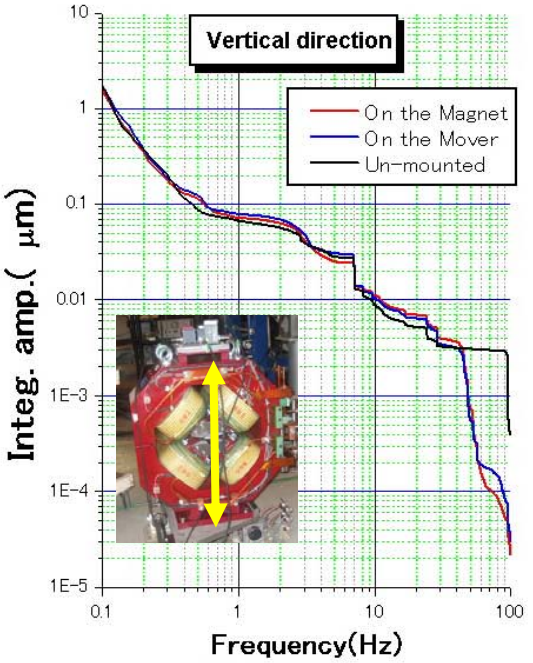

Perpendicular to the magnet
On the Floor
File01
Integ. amp.(μm)
Frequency(Hz)

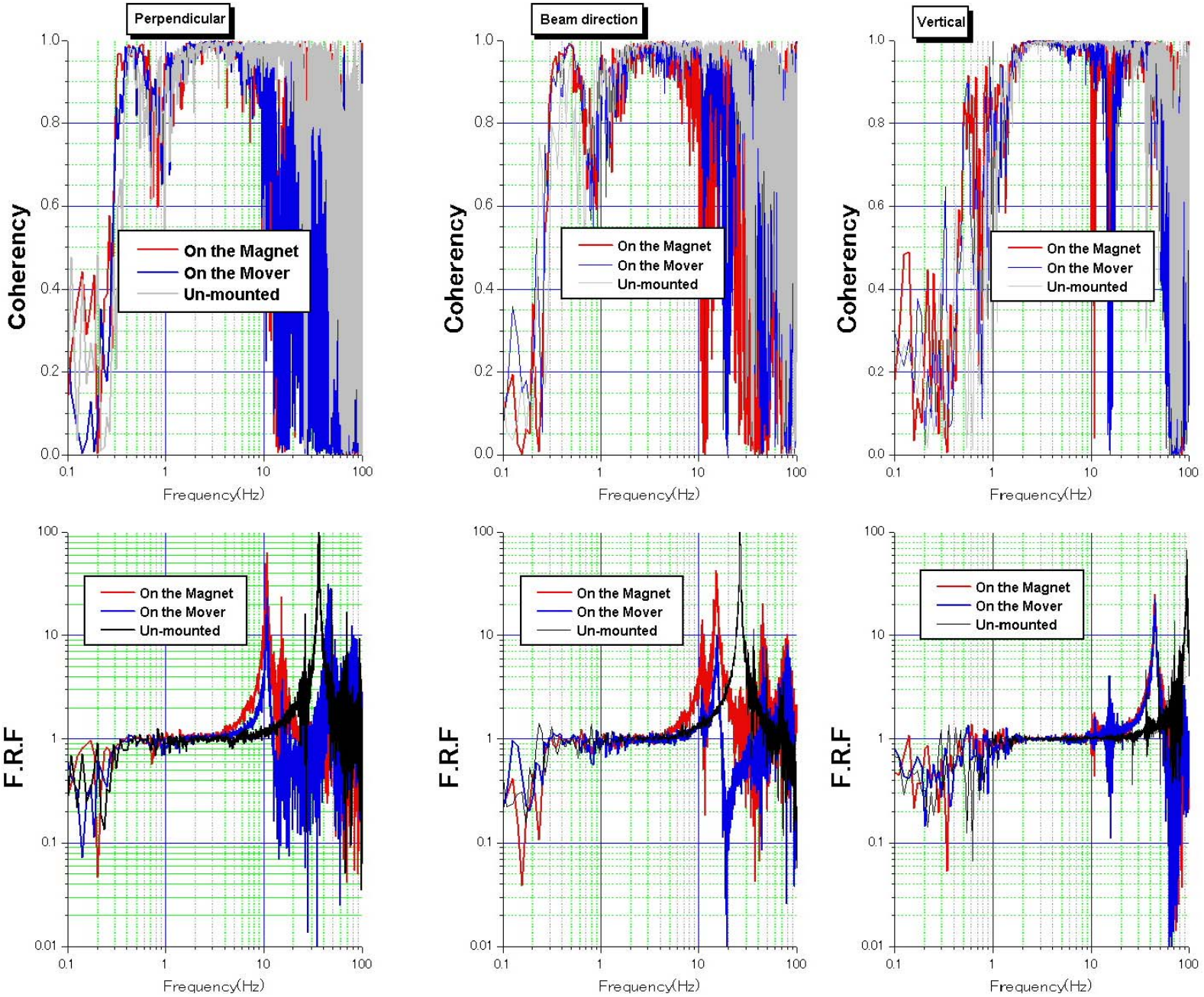

Beam direction
On the Floor
File01
Integ. amp.(μm)
Frequency(Hz)


Vertical direction
On the Floor
File01
Integ. amp.(μm)
Frequency(Hz)


Perpendicular to the magnet
On the Magnet
On the Mover
Un-mounted
Integ. amp.(μm)
Frequency(Hz)


Beam direction
On the Magnet
On the Mover
Un-mounted
Integ. amp.(μm)
Frequency(Hz)


Vertical direction
On the Magnet
On the Mover
Un-mounted
Integ. amp.(μm)
Frequency(Hz)


Perpendicular
Beam direction
Vertical
Coherency
F.R.F
Frequency(Hz)
On the Magnet
On the Mover
Un-mounted

Comparison with the SLAC data

LCC-0036

QUADRUPOLE VIBRATION MEASUREMENTS FOR QM1B AND QC3 IN THE FINAL FOCUS TEST BEAM at SLAC

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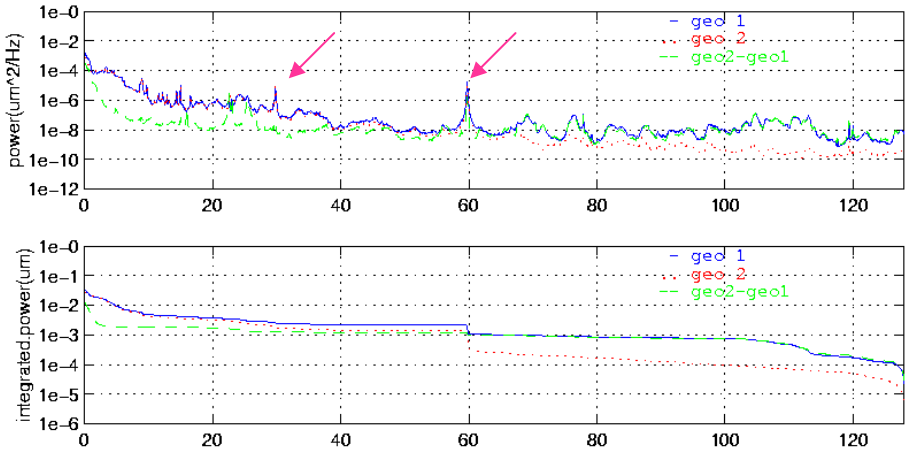
ABSTRACT

We have taken vibration measurements of quadrupoles QM1B and QC3 in the Final Focus Test Beam (FFTB) tunnel at SLAC. We present results for power spectra and integrated power spectra of the vibrations in the frequency range 1 –128Hz. For QM1B, we find 2nm rms vertical motion with respect to the FFTB tunnel floor for f>3Hz. The relevance of this data to NLC performance is discussed. In particular, we estimate a 4% luminosity loss if an IR quadrupole were to have similar vibrations as QM1B.

Vertical direction

QM1B magnet on the anocast steel blocks

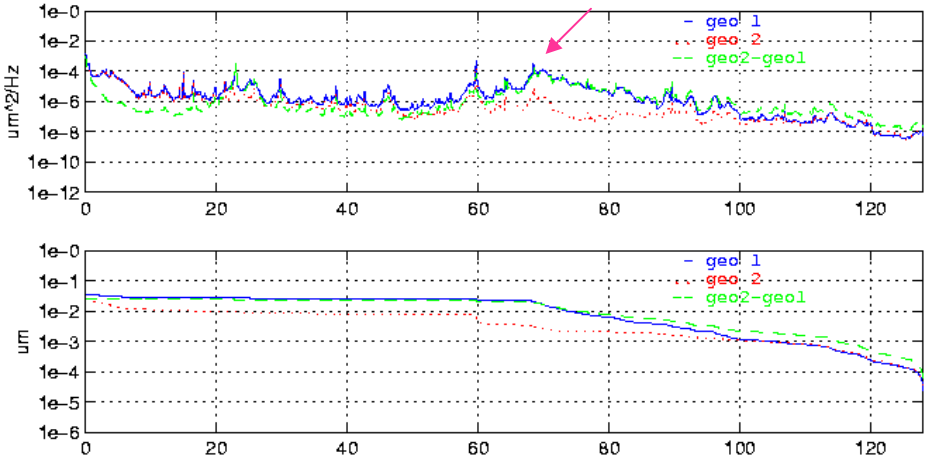


Noise peaks: 60Hz, 30Hz.

At 3Hz, IPS for QM1B is 18nm.

The difference, QM1B-floor, is 2.0nm.

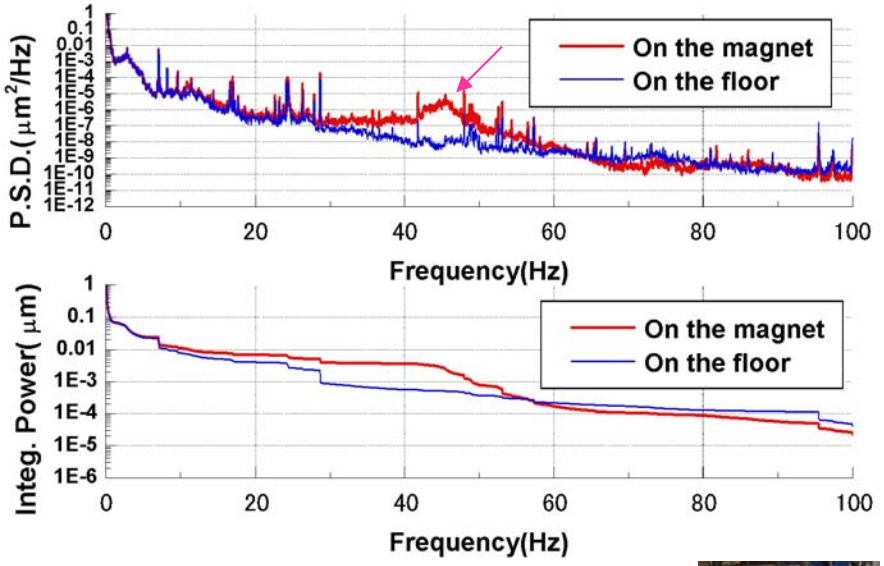
QC3 magnet on the sandstone

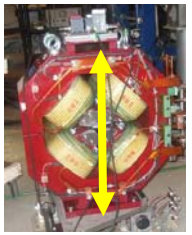


Noise peak: 70Hz.

At 3Hz, IPS for QM1B is 25nm.

QEA magnet on the SLAC movers





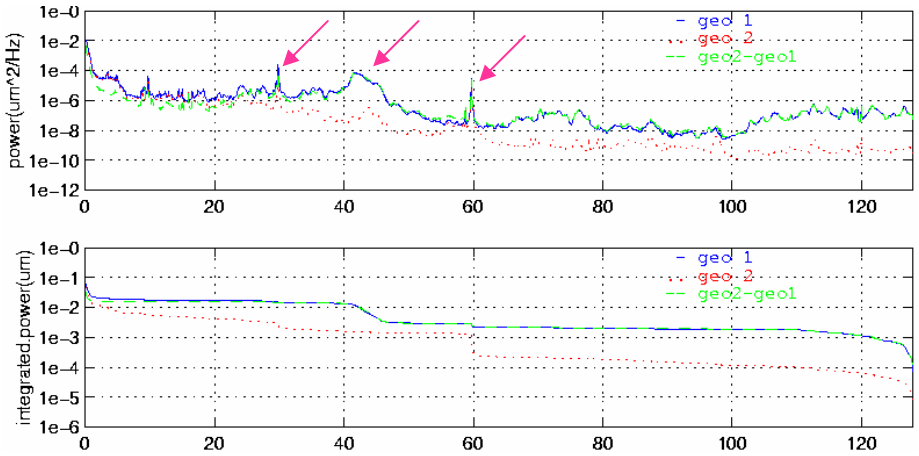
Noise peaks at 45 Hz is observed.

At 3Hz, the IPS for QEA is 43nm

The difference at 3Hz, QEA-floor, is 10nm.

Horizontal direction

QM1B magnet on the anocast steel blocks

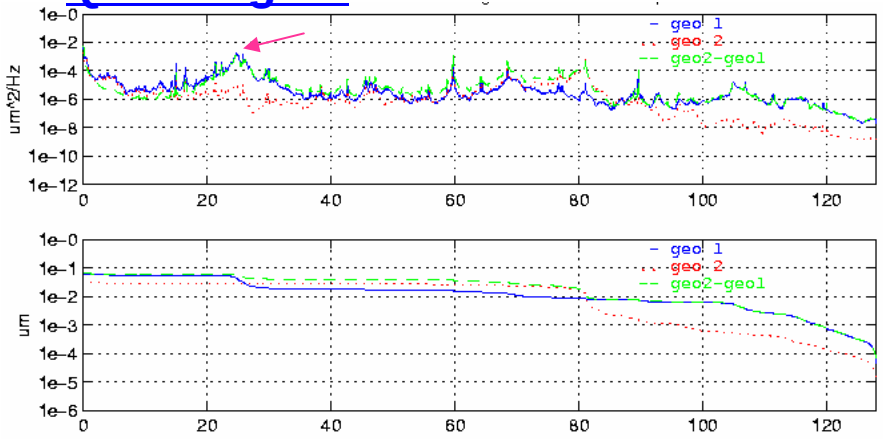


Noise peaks: 60Hz, 30Hz.

Broad resonance near 45 Hz.

At 3 Hz, the difference is 16nm.

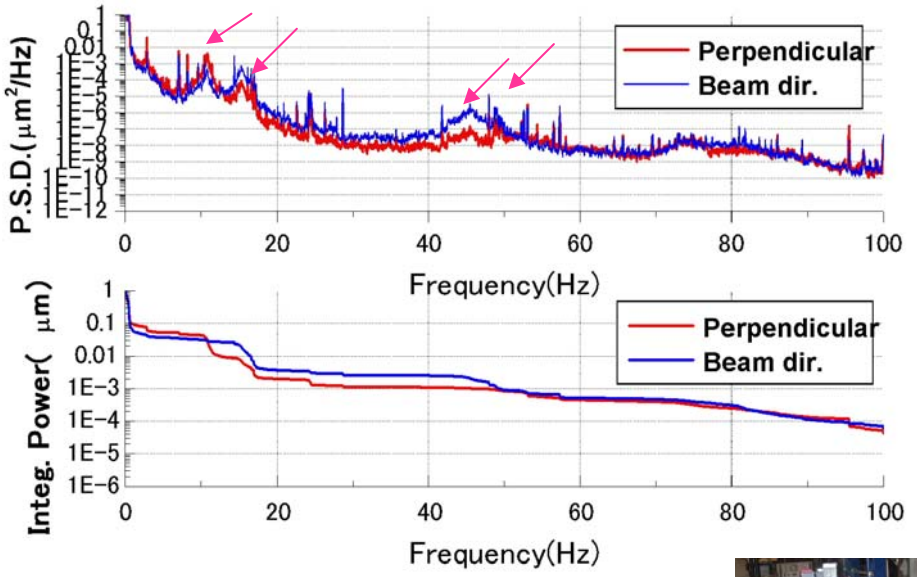
QC3 magnet on the sandstone



Noise peak: 25Hz.

At 3 Hz, the difference is 64nm.

QEA magnet on the SLAC movers



Perpendicular:

Noise peaks at 50 Hz and 10 Hz.

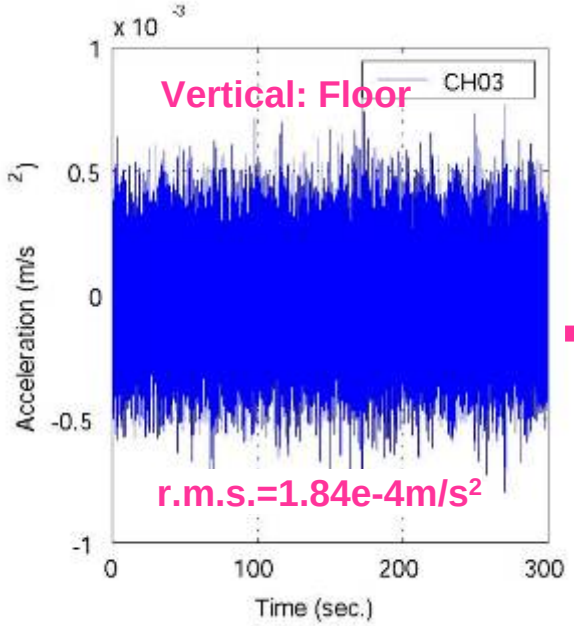
At 3 Hz, the difference is 33nm.

Beam dir.:

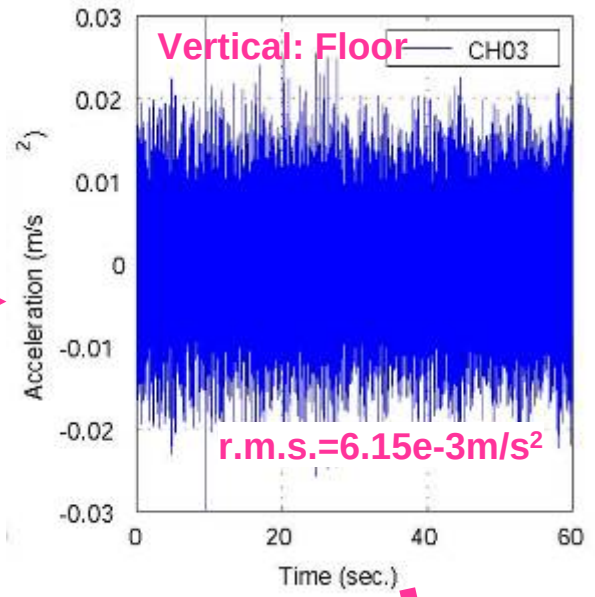
Noise peaks at 80Hz, 45 Hz and 15 Hz.

At 3 Hz, 20nm in beam direction.

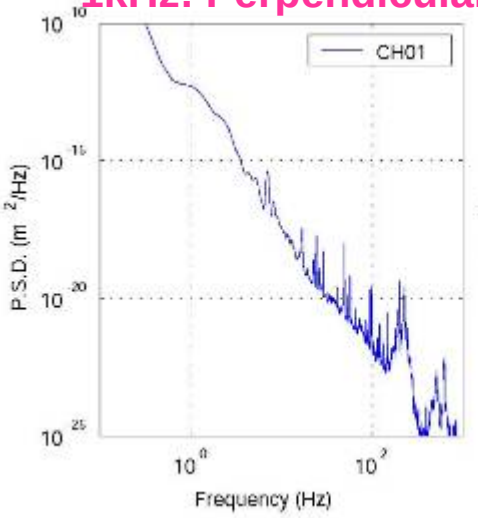
Freq. range: 100Hz



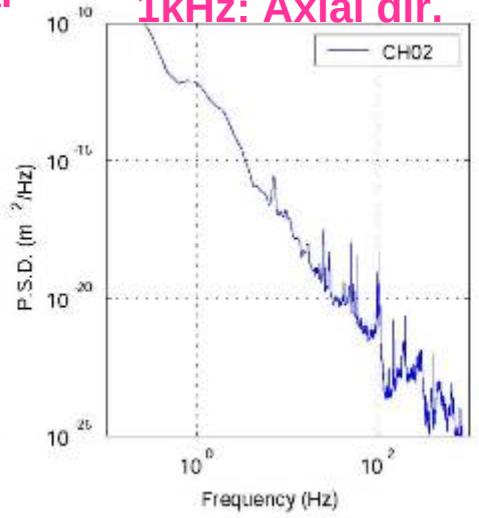
Freq. range: 1kHz



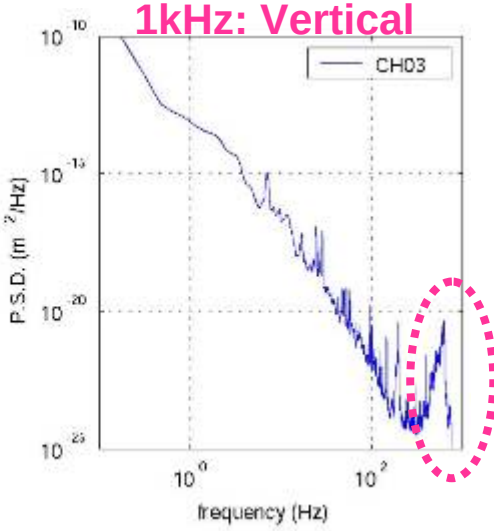
1kHz: Perpendicular



1kHz: Axial dir.



1kHz: Vertical



Conclusion

- Vibration level in Nikko exp. Hall: Same level as ATF beam line.

- Resonant frequency (QEA magnet):

  (On the Magnet, mover)

  Around 10Hz, 50Hz peak in horizontal direction

  Around 35Hz peak in vertical direction

  (Un-mounting from the mover)

  Around 35Hz in horizontal direction

  Higher than 50Hz in vertical direction

- Integrated amplitude (QEA magnet, at 3Hz):

  (On the Magnet)

  Amplitude difference is 20nm in beam direction.

  33nm in perpendicular direction.

  Amplitude difference is 10nm in vertical direction.

- Strong acceleration around 600Hz was observed (In vertical dir.).

  But amplitude level is small.