Ground Motion at ATF/ATF2

T. Tauchi
ATF2 mini-workshop, 5 January 2005, SLAC
GM measurements in 2001.3

Ground Motion Measurement at KEK

2 sensors:
CMG40T (0.033-100Hz)
sampling at 200Hz
Ground Motion in October, 2003, GL and UG(-80m), "incoherent GM"

Days from 1 Jan, 2003

Integrated Amp. at f>10Hz (m)

Integrated Amp. at f>0.1Hz (m)

Days from 1 Jan, 2003
Sensors

Tilt measurements
• Leica Nivel 20 digital tiltmeter

Vibration measurements
• Servo type velocity sensor VSE355G2
  (Tokyo Sokushin Co., LTD.)
  For sensor resolution and huddle test results,
  → http://acfahep.kek.jp/subg/ir/nanoBPM/
• Servo acceleration sensor MG–102S
  (Tokkyo–kiki Co., LTD.)
  For sensor resolution and huddle test results,
  → R. Sugahara et al., “Performance of an active vibration system for GLC”,
Measurement around the beam line (1)

- Measurement Points -

Accelerator Test Facility for JLC

- Observation -

2pm, Feb. 10, 2004 – 6pm, Feb. 11, 2004
30 minutes consecutive duration for 28 hours

Chigasaki Research Institute

J-Power / Electric Power Development Co., Ltd.
Nighttime
(19:00-03:00)

Daytime
(09:00-17:00)

Power Spectrum Density ($\mu$ m$^2$/Hz)

Component : Z (Vertical)
Time zone : Nighttime (7pm-3am)

Frequency (Hz)

Power Spectrum Density ($\mu$ m$^2$/Hz)

Component : Z (Vertical)
Time zone : Daytime (9am-5pm)
Component : Z (Vertical)
Time zone : Nighttime (19:00-03:00)

Nighttime
(19:00-03:00)

Integrated Spectrum (μm)

Frequency (Hz)

10^{-2} 10^{-1} 10^{0} 10^{1} 10^{2}

Component : Z (Vertical)
Time zone : Daytime (09:00-17:00)

Daytime
(09:00-17:00)

Integrated Spectrum (μm)

Frequency (Hz)

10^{-2} 10^{-1} 10^{0} 10^{1} 10^{2}
"Coherence (3)"

Component: Z (Vertical)

Nighttime (19:00-03:00)

Daytime (09:00-17:00)

Nighttime (19:00-03:00)

Daytime (09:00-17:00)

Chigasaki Research Institute

J-Power / Electric Power Development Co., Ltd.
Floor vibrates on windy days. Unfortunately no data taken over this weekend at the current ATF beam line.

ATF2 floor vibration, wind speed and wave height

0.3Hz component follows wind speed??

0.1Hz component follows wave height??

Floor vibrates on windy days. Unfortunately no data taken over this weekend at the current ATF beam line.

GL-UD : 0.1Hz

Surface

m

10^-7

10^-6

10^-5

710 720 730

UG-UD : 0.1Hz

Underground: -80m

heavy weather, 12/5-6, Sun-Mon.

Earthquake in Sumatra, 10am, 12/26, Sunday

Day from 1st January
Floor tilt comparison

ATF beam line

ATF2

Tolerance of $8\mu$rad for Bend at ATF2. (Kuroda) [10% beam size growth ]

M. Masuzawa,
2nd mini-workshop on nano project at ATF,
11 Dec. 2004
Comparison between ATF (Jpower meas. Feb.) & ATF2 (Dec.)

Red: ATF2
Blue: ATF

Difference in vertical direction is largest.

Agrees with Yamaoka's measurement.

Fair comparison? "Noiser around ATF2 (chiller pumps near by, other activities going on, etc.)

Taken on different days.

Day-to-day fluctuations in ATF2 area?

$V \sim 13\text{Hz}$

Amplitude of GM

Final-Q must be stabilized!

Also, IP-BPM!

M. Masuzawa, 2nd mini-workshop on nano project at ATF, 11 Dec. 2004
Comparison between ATF (Jpower meas. Feb.) & ATF2 (Dec.)

Red : ATF2
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Difference in vertical direction is largest.

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Fair comparison??

“Noisier” around ATF2 (chiller pumps near by, other activities going on, etc.)

Taken on different days.

Day-to-day fluctuations in ATF2 area?

X orthogonal to beam line

100nm for Δx*=0.4μm

Amplitude of GM

2/10 Beam Line X
12/3 ATF2 Floor X

Amplitude (micron)

10nm
1μm

frequency (Hz)

0, 1
1
10Hz

0, 1
1
10Hz

V ~13Hz

~25Hz

M. Masuzawa
2nd mini-workshop on nano project at ATF
11 Dec. 2004
A further analysis was carried out on the 13-Hz peaks in the QB4RP PSD system. Direction
Natural frequency (Hz) and fitting errors
Damping factor (%)
X 13.95 +/- 0.01 1.9
Y 13.00 +/- 0.01 1.4

“Tall magnet”: 2ton, 1.9m tall from floor
Vertical motion at 400kg magnet on the pneumatic controlled table.
Suppression factor of active violation isolation system in vertical direction
0.5m thick concrete floor supported by tall columns
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