Mount stabilization for Shintake monitor-4

4th ATF2 project meeting (May 31, 2007)

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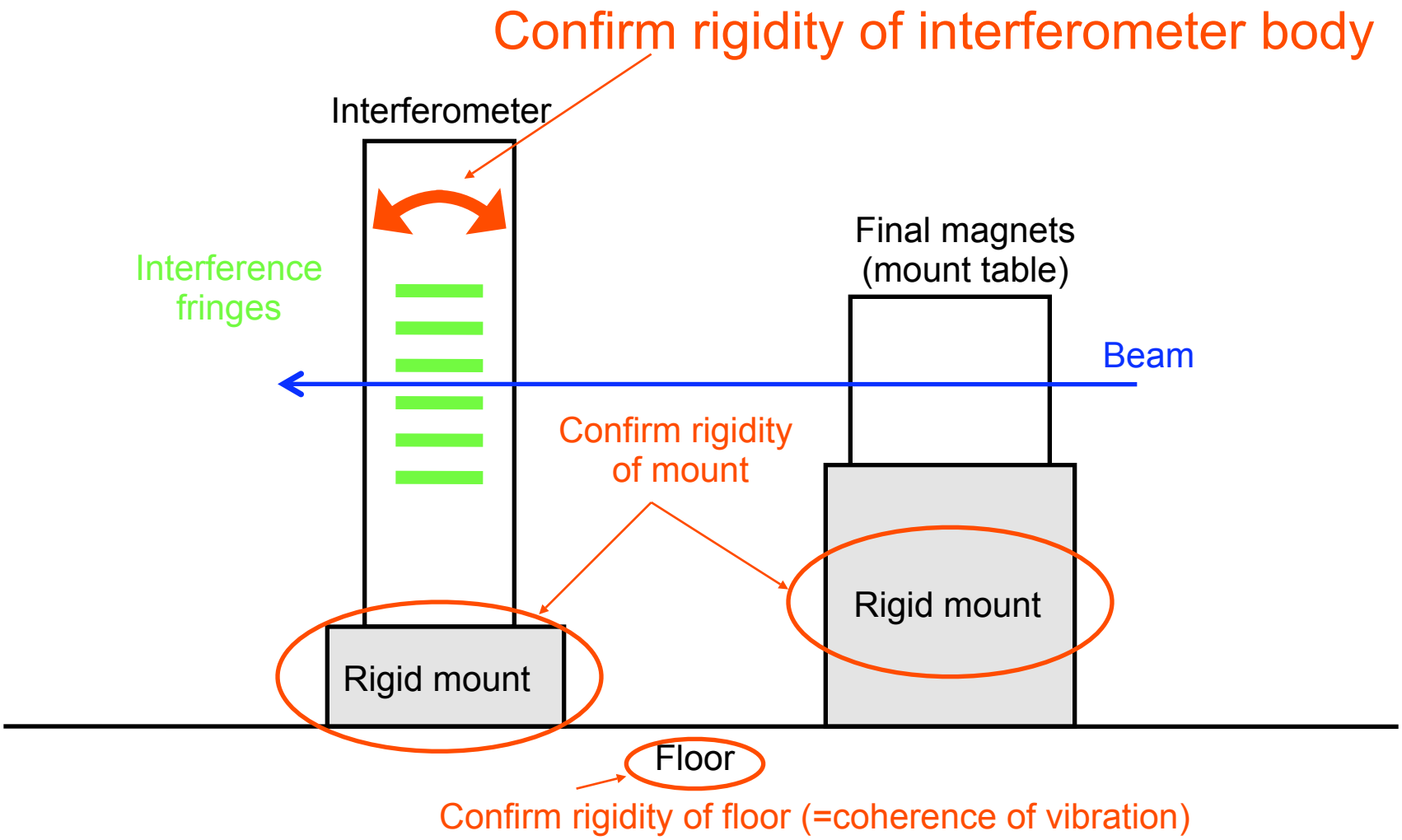
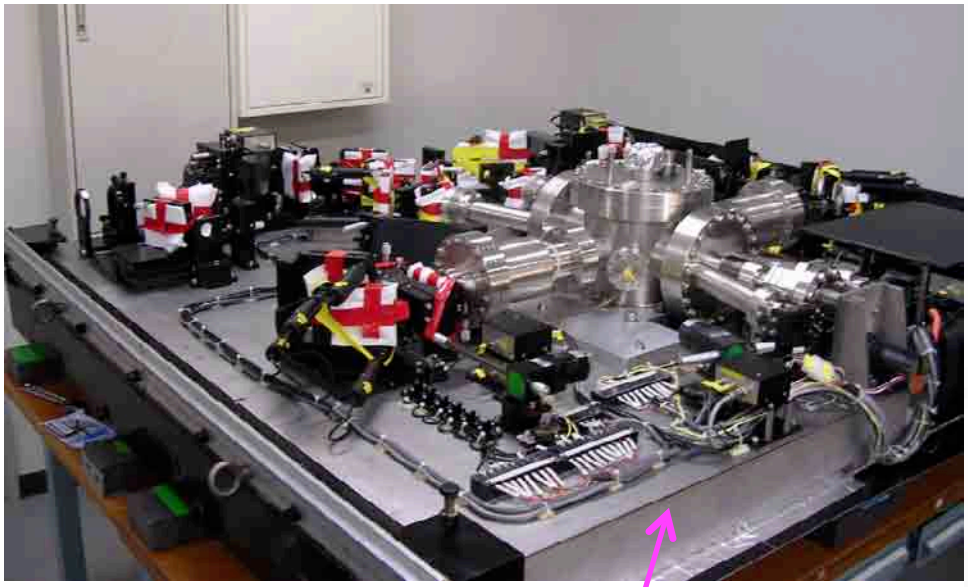
Rigid mount on floor for 1st step consideration

using individual rigid mount for supporting interferometer (Shintake monitor)
and Final focusing magnets (and their mount table)

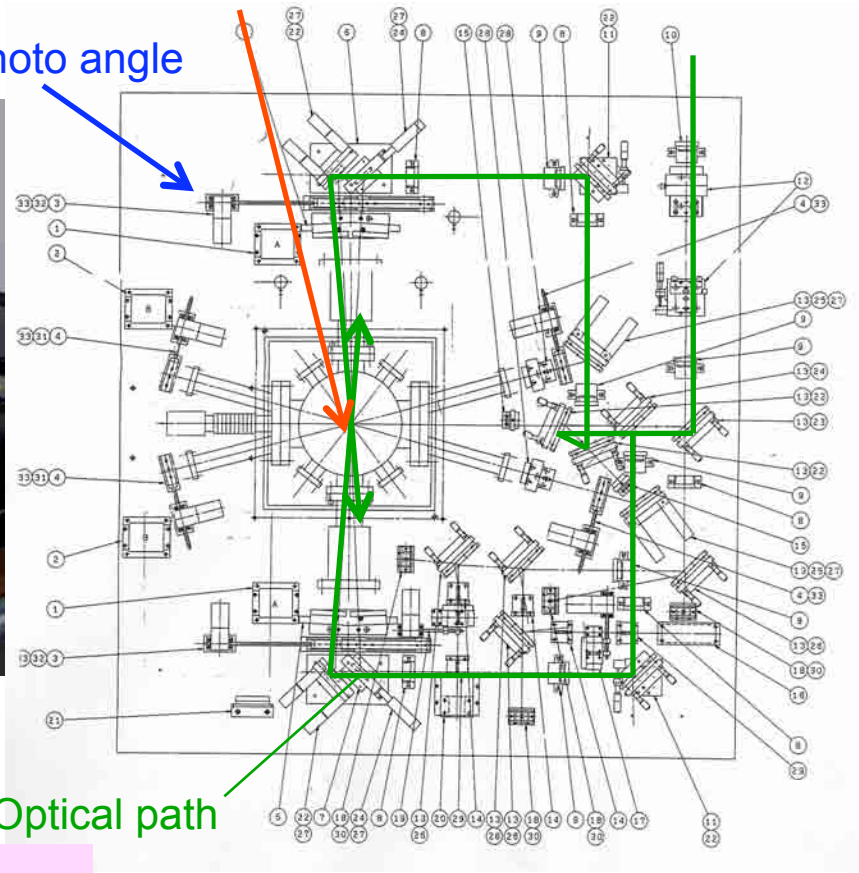


Interferometer of Shintake monitor

Using optical table (1.6×1.5×0.11 m) to mount optics, total weight of ~740kg



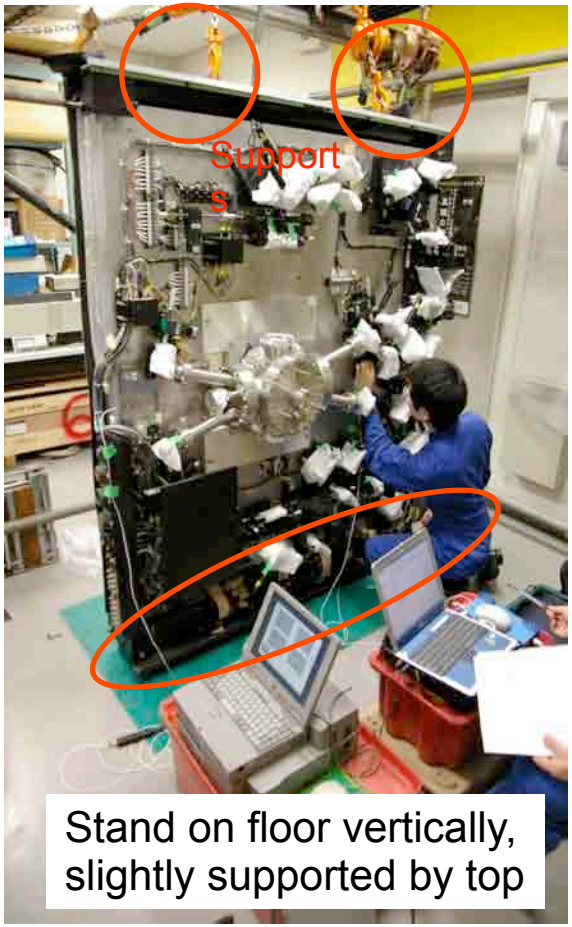
Photograph of the interferometer laid for adjustment,
The optical table is supported vertical in usage.

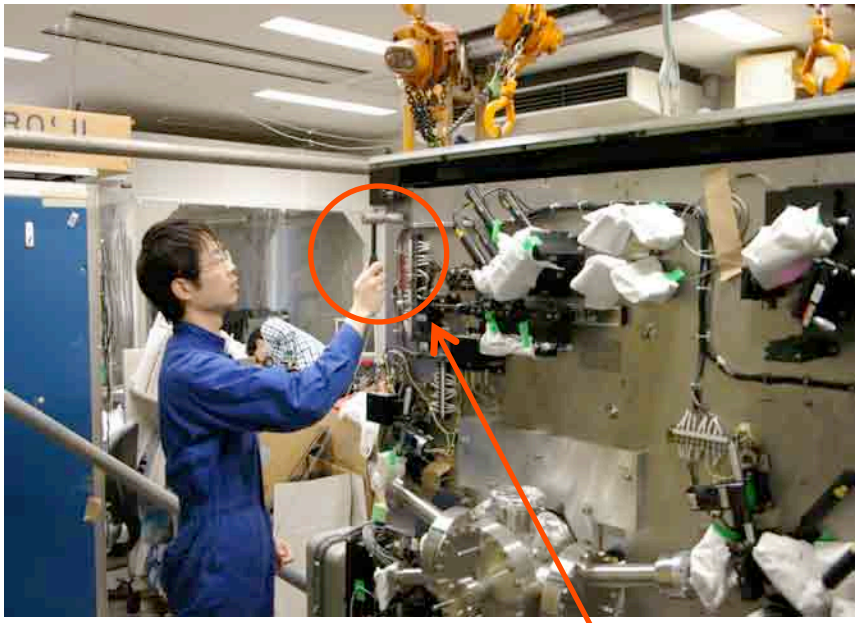


Optical table has 110 mm-t, and ~220 kg-w,
consisted of 5 mm-t top and bottom of stainless steel plates
and ~100 mm-t Al honeycomb core (AL3/8-5052-003)

Measurement of impulse response for confirming rigidity of interferometer

(by HERZ co. ltd., Feb. 2007, 10F of building @Univ. of Tokyo)





Hit by impulse hammer and measure response by Acc. sensor.

Acc. sensor
~10mV/m/s^2, f_0~33kHz

Measurement points and an example of measured impulse responses

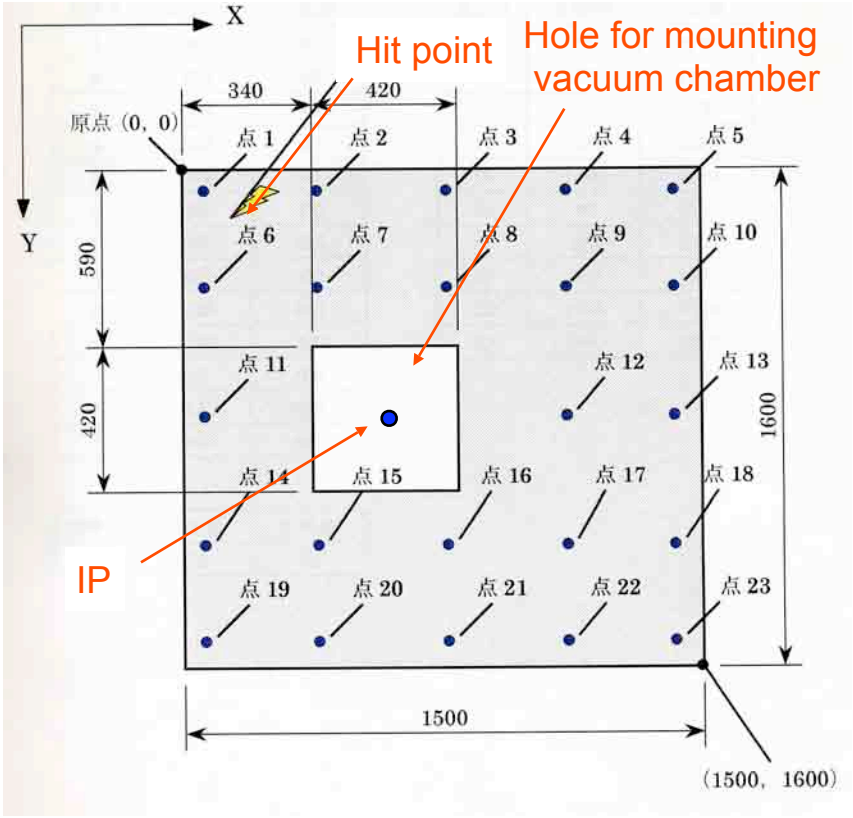


Fig. Measurement points (23 points) and a hit point on optical base plate.

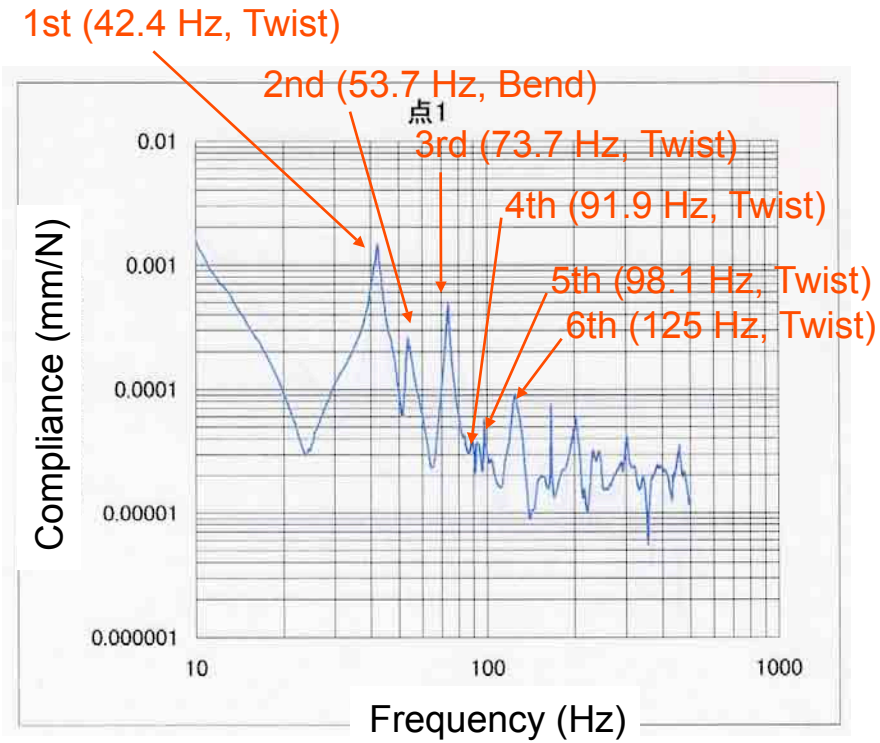
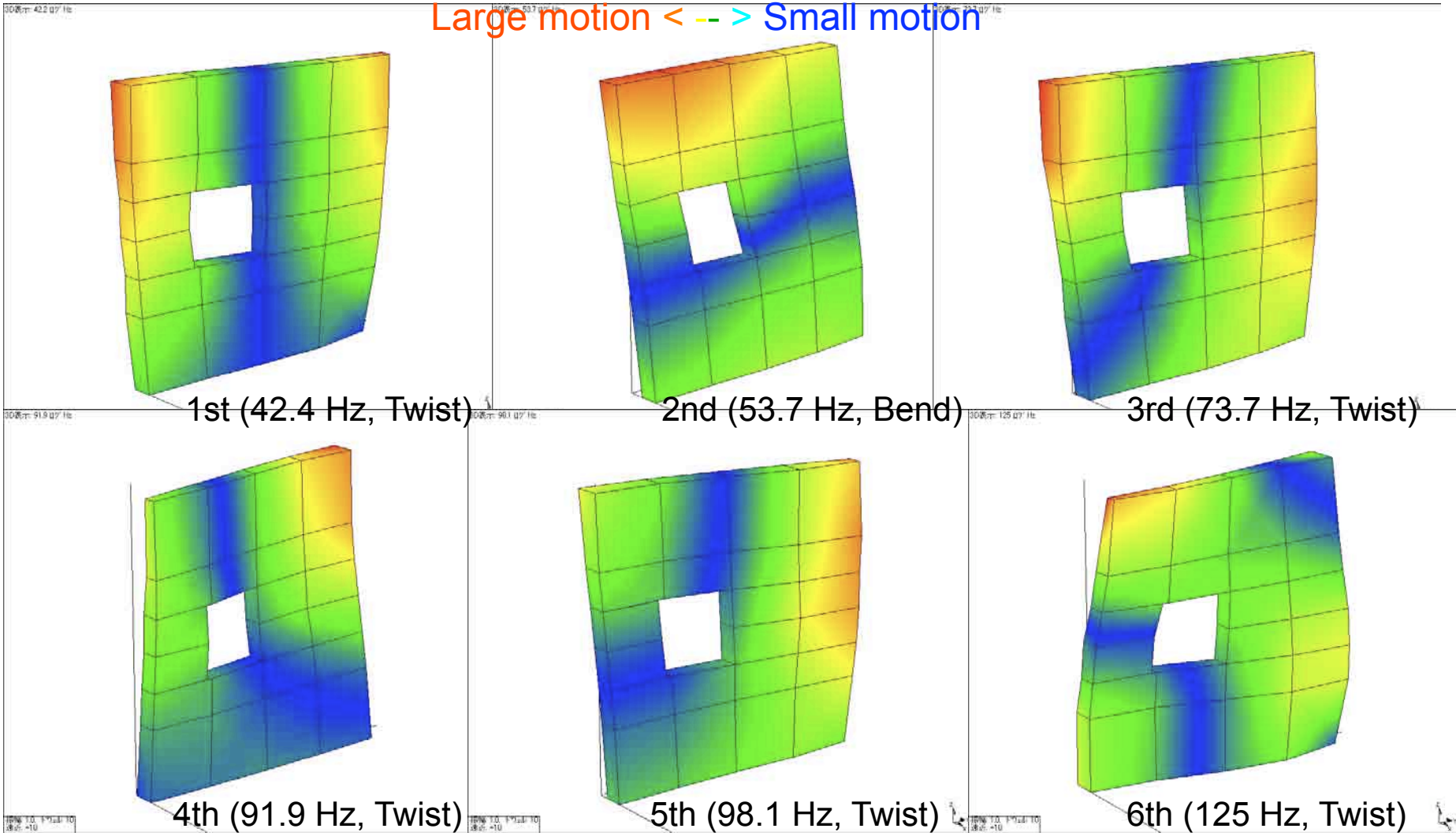


Fig. Example of measured impulse response at measurement point 1.

Measured deformation modes for interferometer (1st ~6th)

Large motion < -- > Small motion



1st (42.4 Hz, Twist)

2nd (53.7 Hz, Bend)

3rd (73.7 Hz, Twist)

4th (91.9 Hz, Twist)

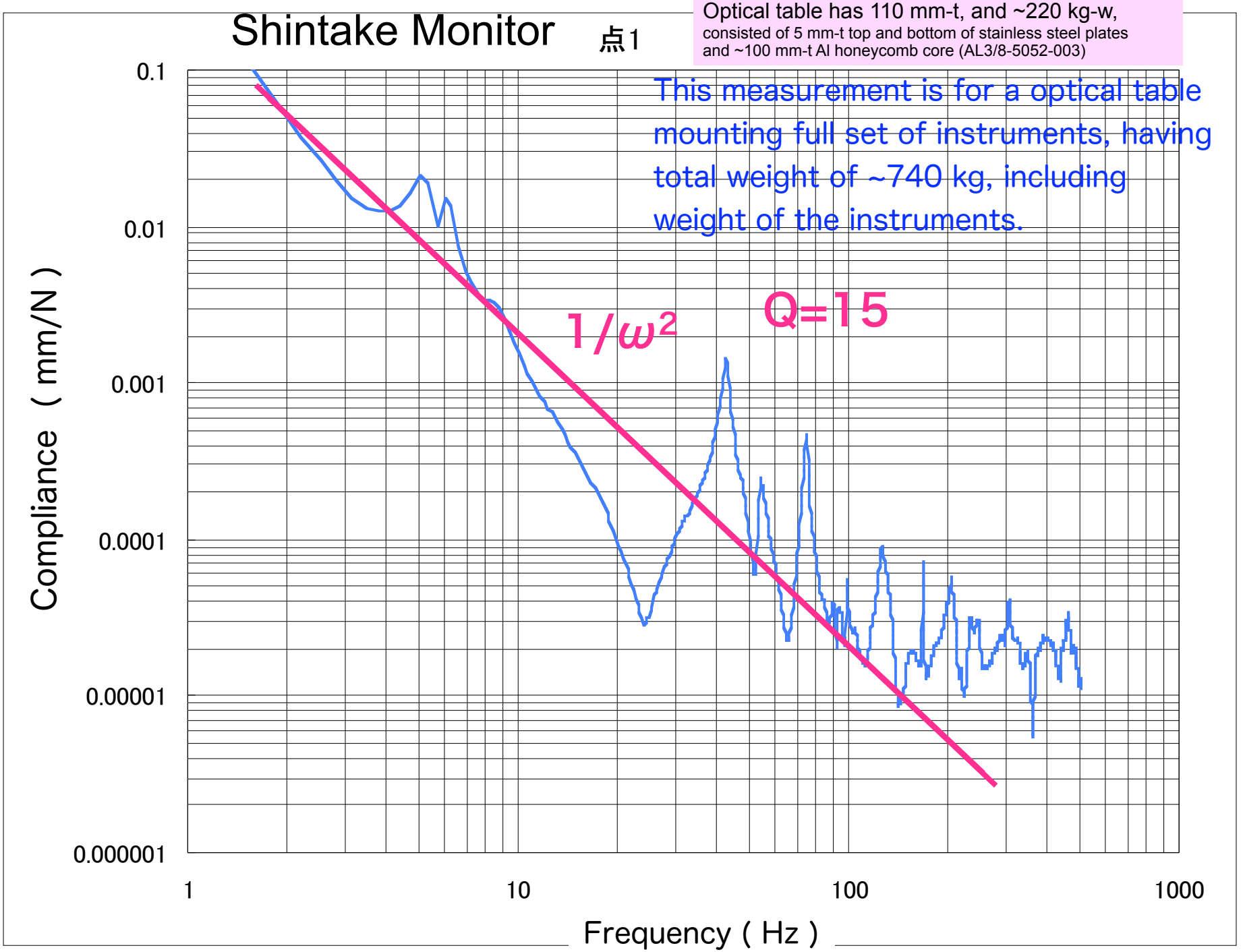
5th (98.1 Hz, Twist)

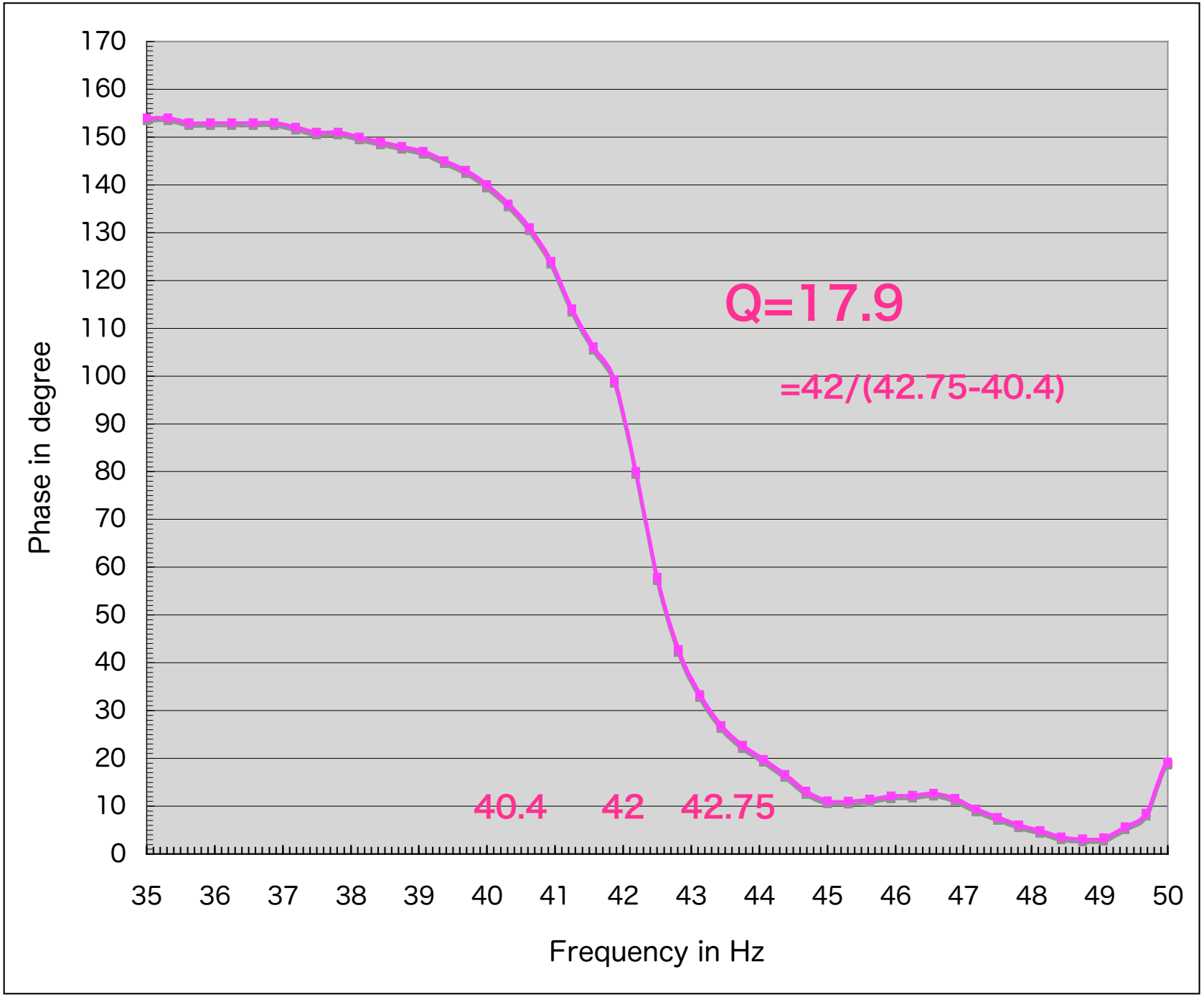
6th (125 Hz, Twist)

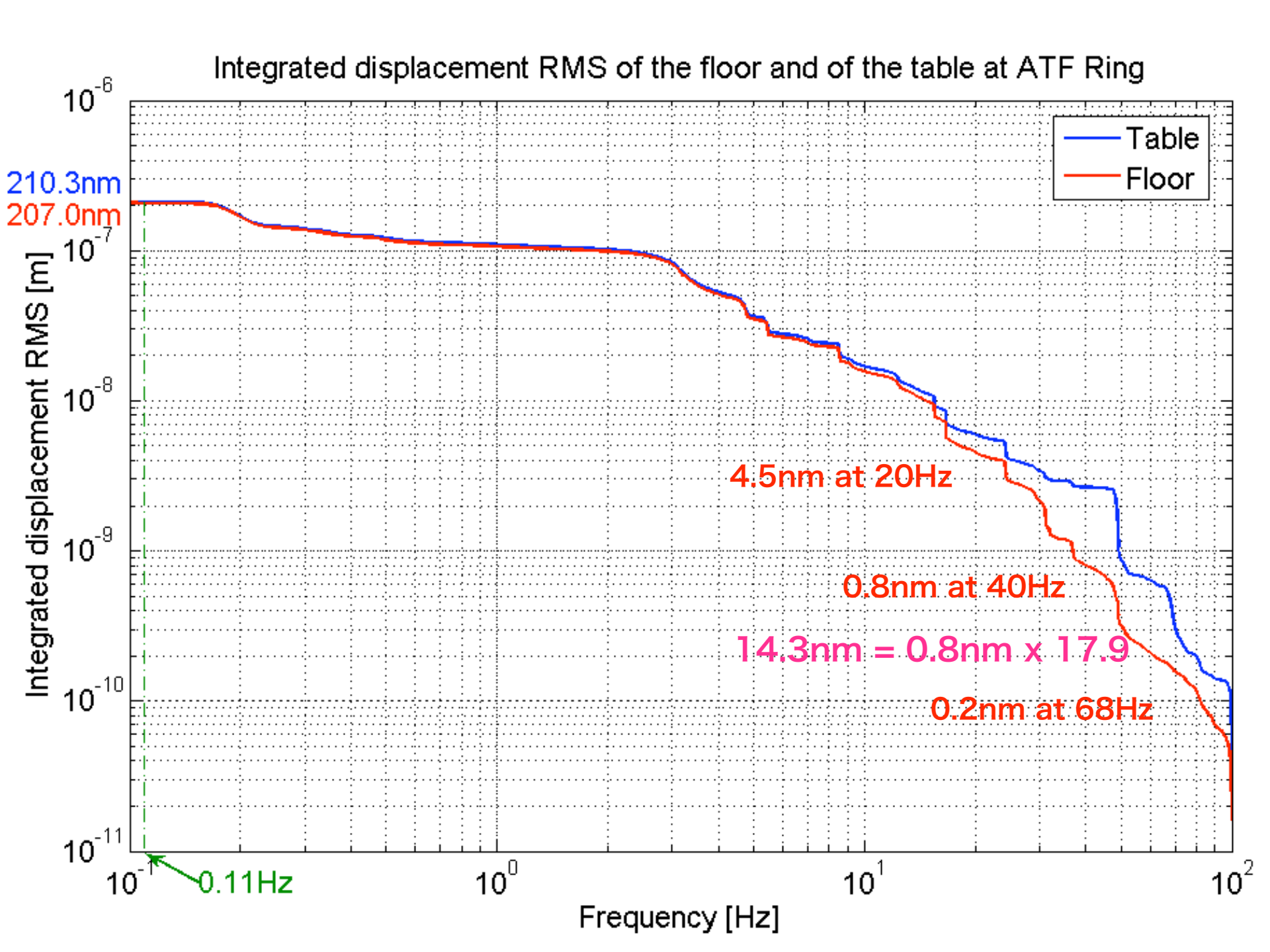
Results of measurement

- The first eigenfrequency was measured to be 42 Hz with full set of instruments on the table.
- It was calculated to be 130Hz with no instrument (free-free configuration).

Remark : eigenfrequency depends on the support .


Shintake Monitor
点1
Optical table has 110 mm-t, and ~220 kg-w,
consisted of 5 mm-t top and bottom of stainless steel plates
and ~100 mm-t Al honeycomb core (AL3/8-5052-003)
This measurement is for a optical table mounting full set of instruments, having total weight of ~740 kg, including weight of the instruments.
1/ω²
Q=15
Compliance (mm/N)
0.1
0.01
0.001
0.0001
0.00001
0.000001
1
10
100
1000
Frequency (Hz)


Phase in degree
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
Frequency in Hz
Q=17.9
=42/(42.75-40.4)
40.4
42
42.75


Integrated displacement RMS of the floor and of the table at ATF Ring
Table
Floor
210.3nm
207.0nm
4.5nm at 20Hz
0.8nm at 40Hz
14.3nm = 0.8nm x 17.9
0.2nm at 68Hz
0.11Hz
Integrated displacement RMS [m]
Frequency [Hz]
10^-6
10^-7
10^-8
10^-9
10^-10
10^-11
10^-1
10^0
10^1
10^2

Suggestion of rigid mount by HERZ co.

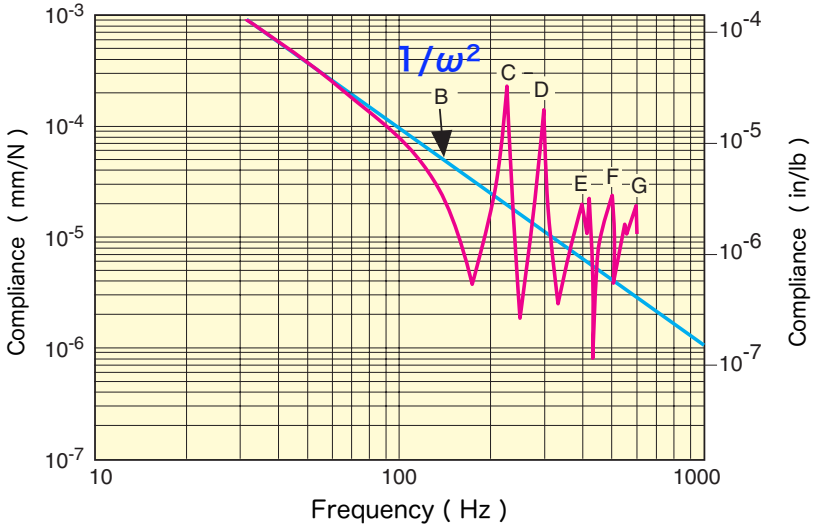
Increase rigidity of interferometer body (=Increase 1st elgenfrequency) with full instruments on;

- by using 250 mm-t Al honeycomb plate
  -> ~74 Hz

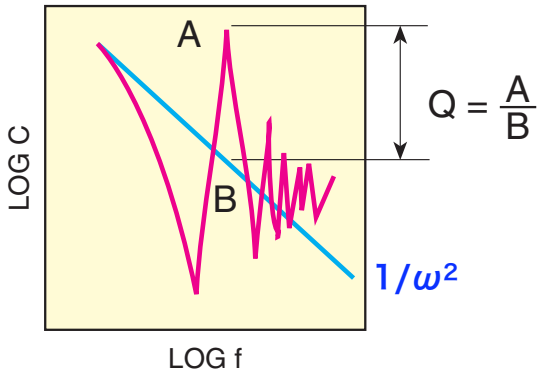
- by using 200 mm-t steel honeycomb plate
  -> ~82 Hz

- by using 250 mm-t steel honeycomb plate
  -> ~112 Hz

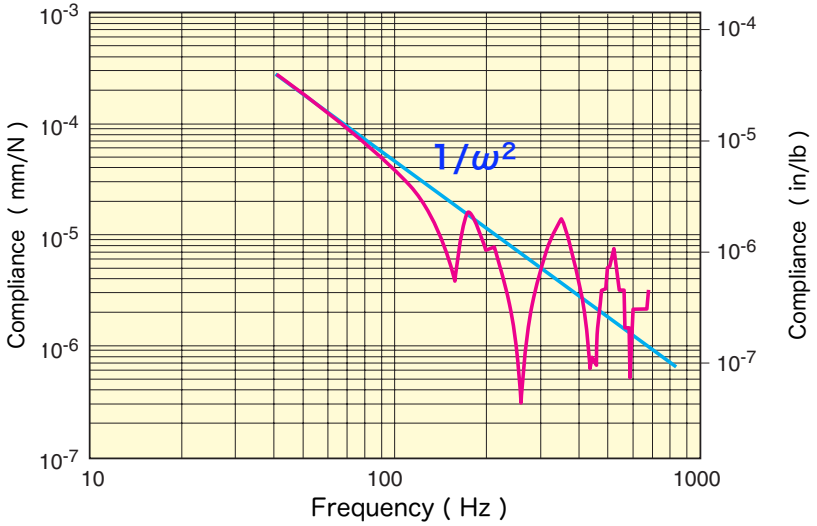
Remark : eigenfrequency depends on the support .



Aluminum Honeycomb



Maximum amplification at resonances (Q)



Steel Honeycomb

Steel Honeycomb $Q = \frac{1.4\times10^{-5}}{3.9\times10^{-6}} \cong 4$

Aluminum Honeycomb $Q = \frac{2.2\times10^{-4}}{1.9\times10^{-5}} \cong 12$

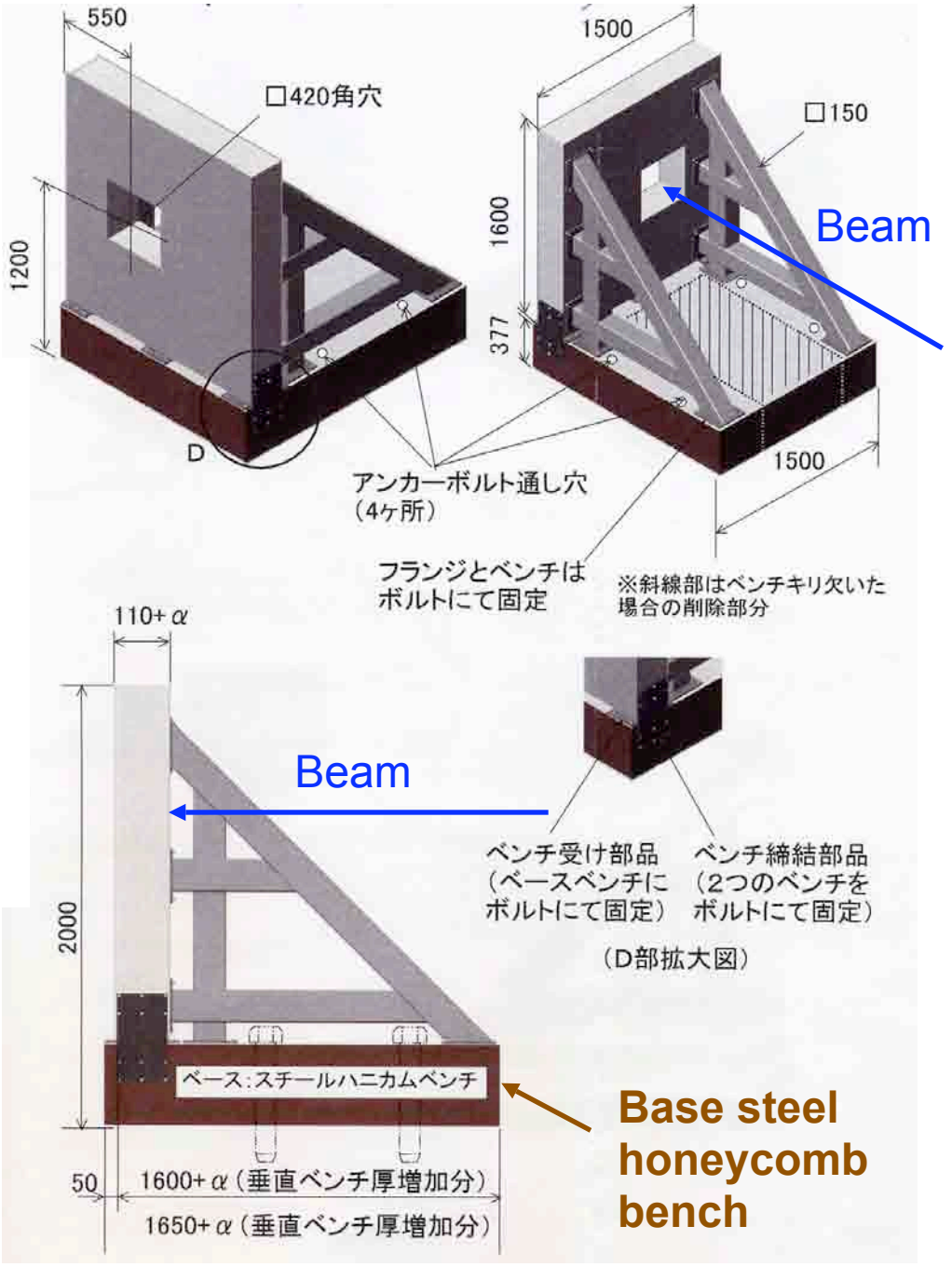
Granite table $Q = \frac{2.3\times10^{-4}}{5\times10^{-7}} \cong 460$

from Newport co. ,www.newport-japan.jp/pdf/vc_0852.pdf

Support structure

-> Mount on a base steel honeycomb bench.

-> Fix the bench on floor by anchor bolts tightly.



Plan

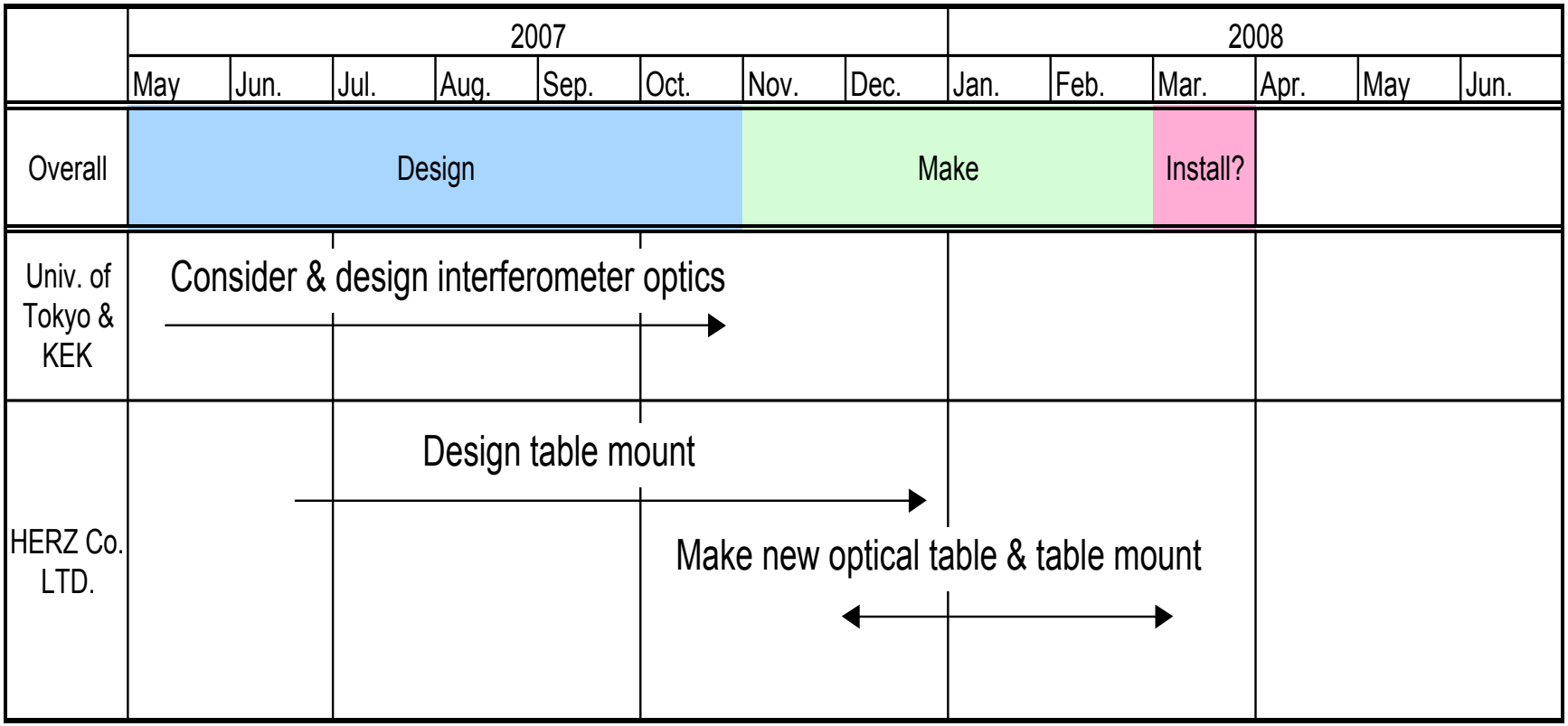
Study & design interferometer optics (Univ. of Tokyo & KEK)

- Study interferometer optics optimized for ATF2.
- Design mounting holes for the new optics on the table by end of October 2007 for fabrication ready.

- Design (HERZ co.)
  - Design a rigid support for the optical table.
    - for present table, then a new table

- Fabrication (HERZ co.)
  - Make a new optical table and a support (with new mounting holes)
    Or
  - Make only a support for the present table.

Schedule


2007
2008
May
Jun.
Jul.
Aug.
Sep.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
Jun.
Overall
Design
Make
Install?
Univ. of Tokyo & KEK
Consider & design interferometer optics
HERZ Co. LTD.
Design table mount
Make new optical table & table mount