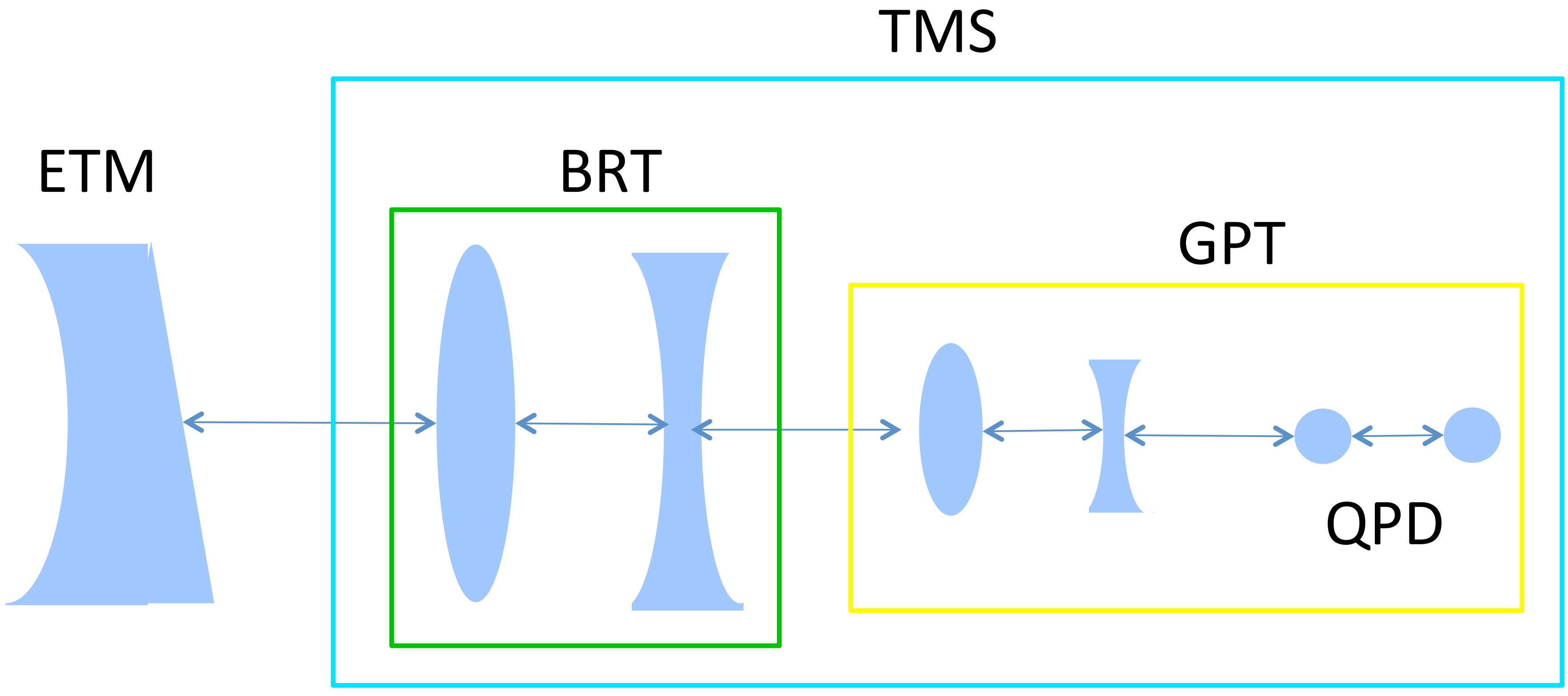
Displacement of BRT

Junko Katayama

Transmission Monitor System



What I did

Lateral and angular motion of BRT cause the noise on QPDs.

I computed those BRT motion noise and shot noise for both SOFT and HARD mode in two cases ;

- TMS table fixed on the ground
- TMS suspended by pendulum

Angular motion

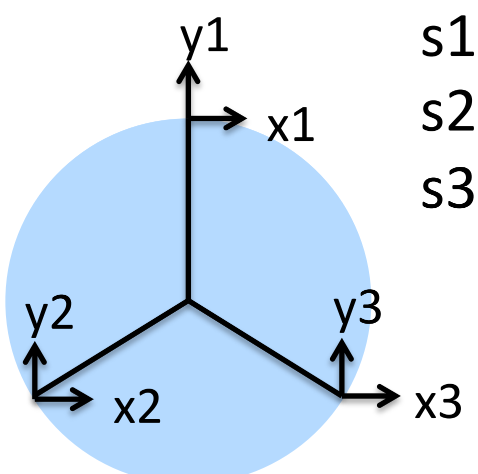
There are two types of angular motion.

1. Surface wave on the ground (v=5000m/s)

$$\Theta = 2\pi f * x_{seis} / v$$

2. Table motion (simulation data from ATC)

Z-rotation



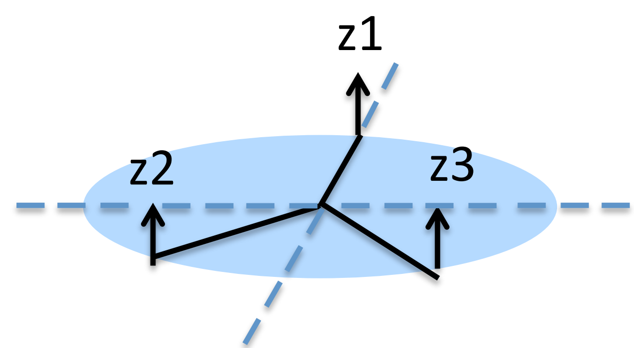
$s1 = x1$

$s2 = -1/2*x2 + \sqrt{3}/2*y2$

$s3 = -1/2*x3 - \sqrt{3}/2*y3$

$R\theta z = (s1+s2+s3)/3$

X,Y-rotation



$R\theta xy = (((z2+z3)/2)*2-z1)$

Angular motion
comparing surface wave & table move

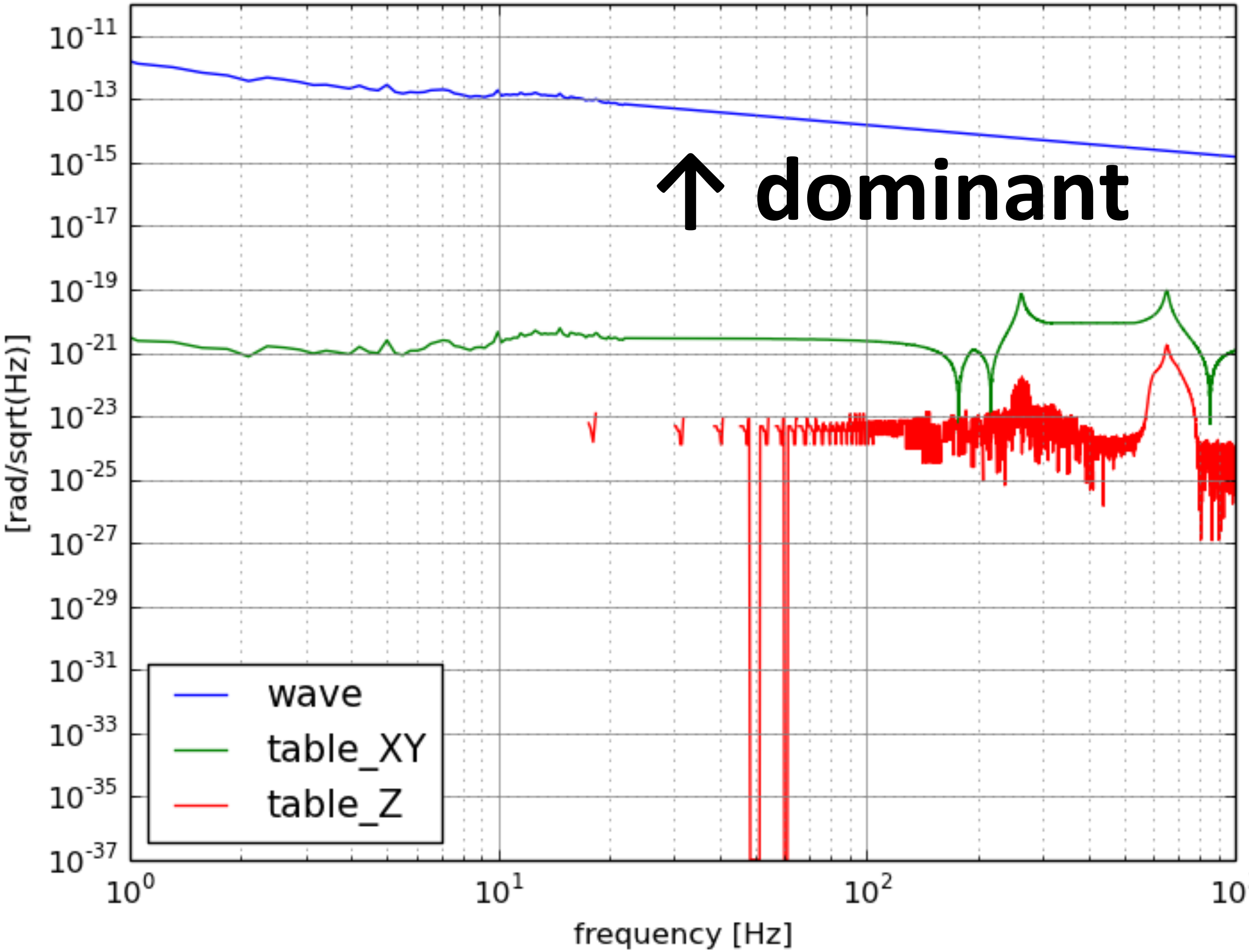


Table motion is quite smaller than surface wave
→ consider only surface wave as the angular motion of BRT

From the next slide,

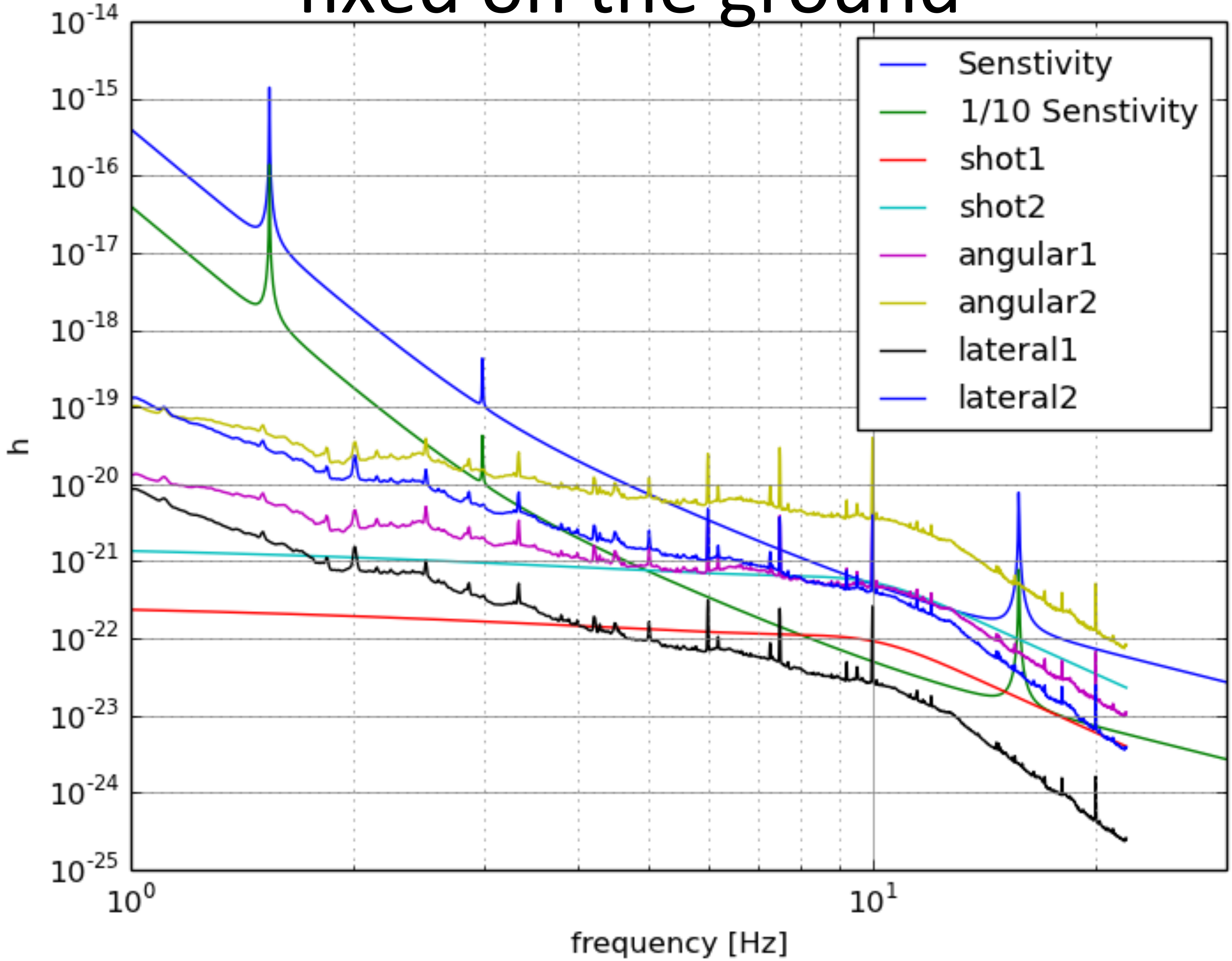
I computed the noise contribution to h for each SOFT and HARD mode.

There are two lines with each noise ;

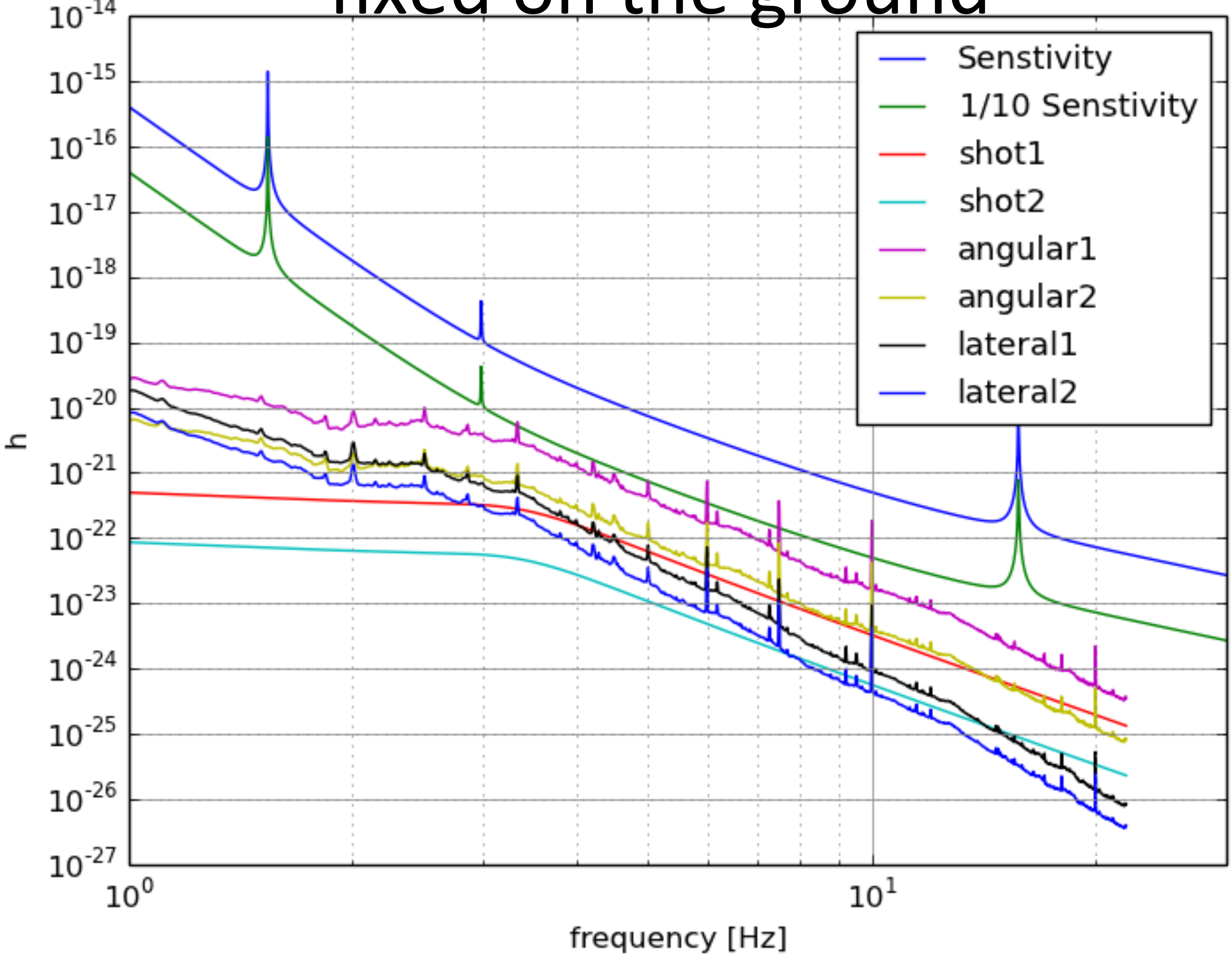
Ex) shot1 : shot noise on QPD1

shot2 : shot noise on QPD2

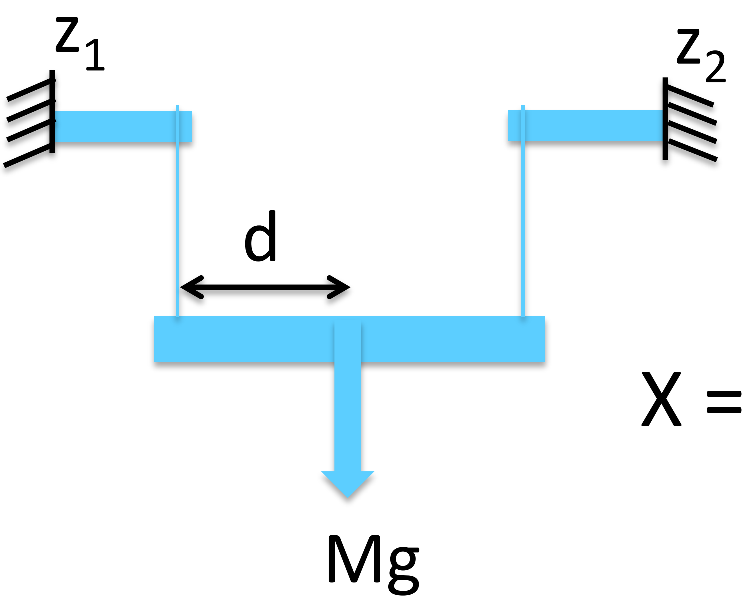
SOFT mode
fixed on the ground



HARD mode
fixed on the ground



Transfer Function



↑
Suspended by
2 wires

d=1m , M=200kg

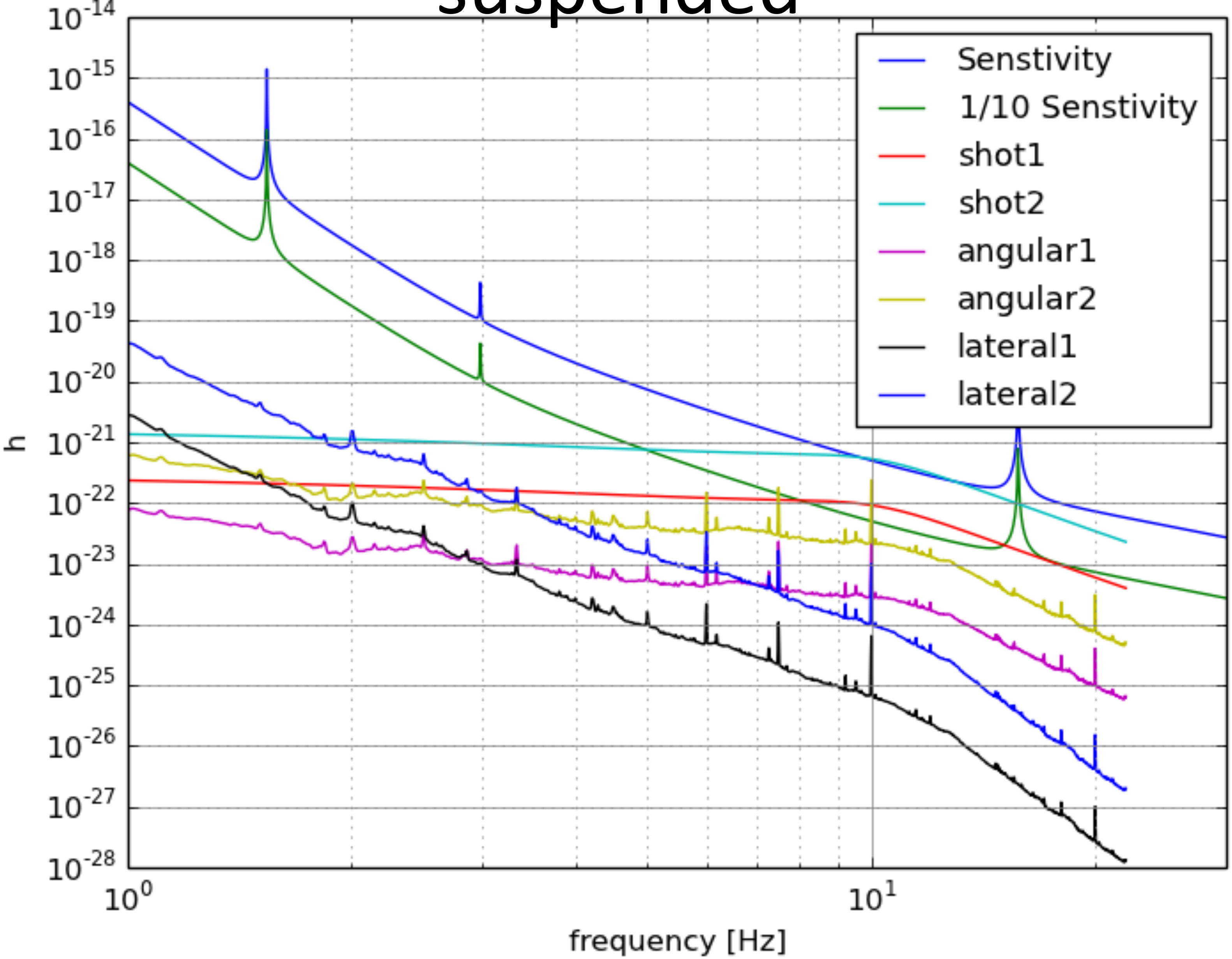
$$X = 1/(1-(\omega/\omega_0)^2+i\omega/Q\omega_0)*\color{blue}{x_{seis}}$$

$$\Theta = dk(1\%*\color{blue}{x_{seis}})/(-Iw^2+2d^2k)$$

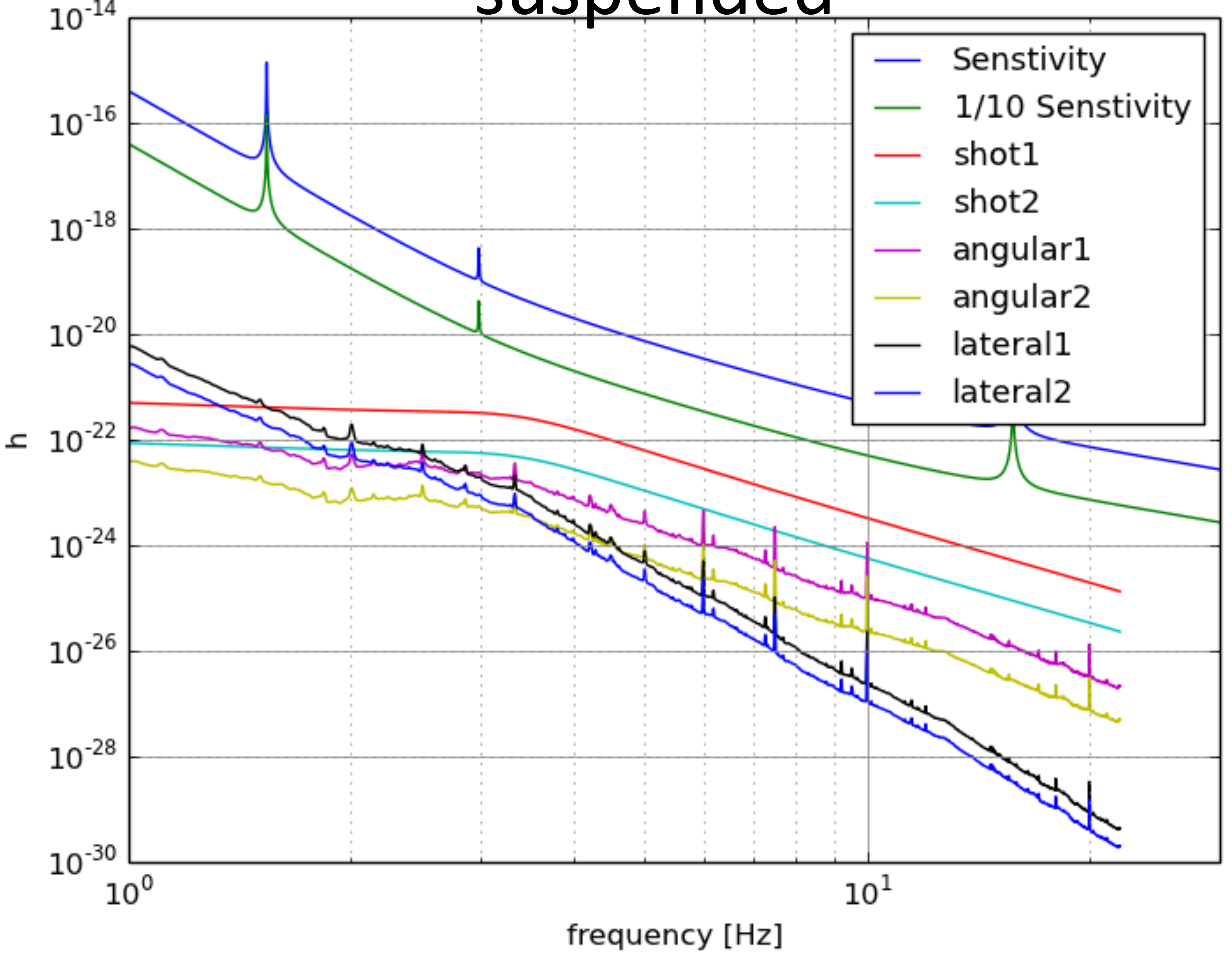
$$z_2-z_1=1\%*\color{blue}{x_{seis}}$$

$$I=M(2d)^2/12$$

SOFT mode suspended



HARD mode suspended



Conclusion

- rotation of TMS table is not dominant

→ surface wave is dominant

- we can get HARD signal with TMS suspended

…cannot get SOFT because of the shot noise