National Synchrotron Radiation Research Center

Water Flow Vibration In The NSRRC

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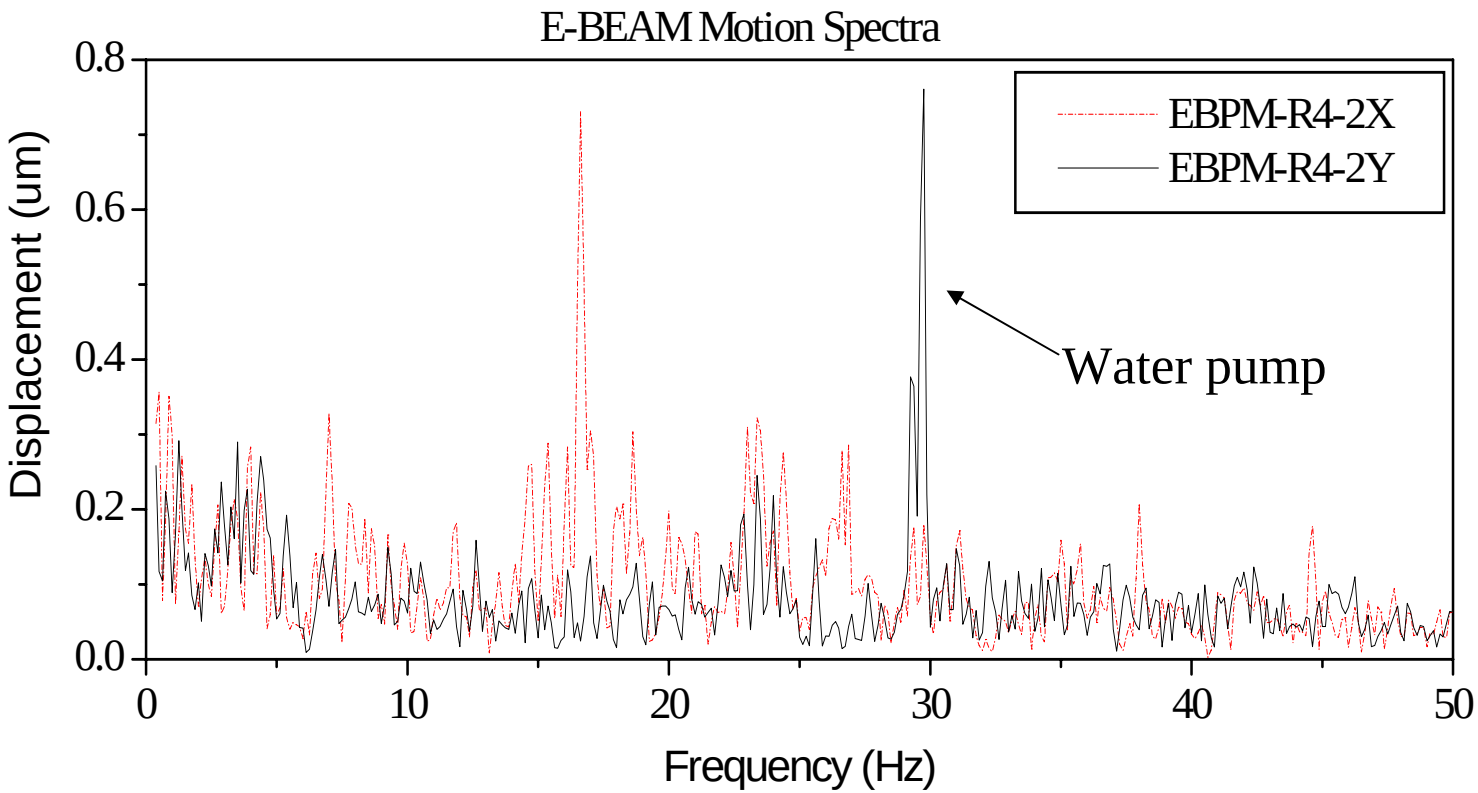
Outline

1. Motivation.
2. BPM reading.
3. Source identification.
4. Actions
5. Flow station test.
6. Summary

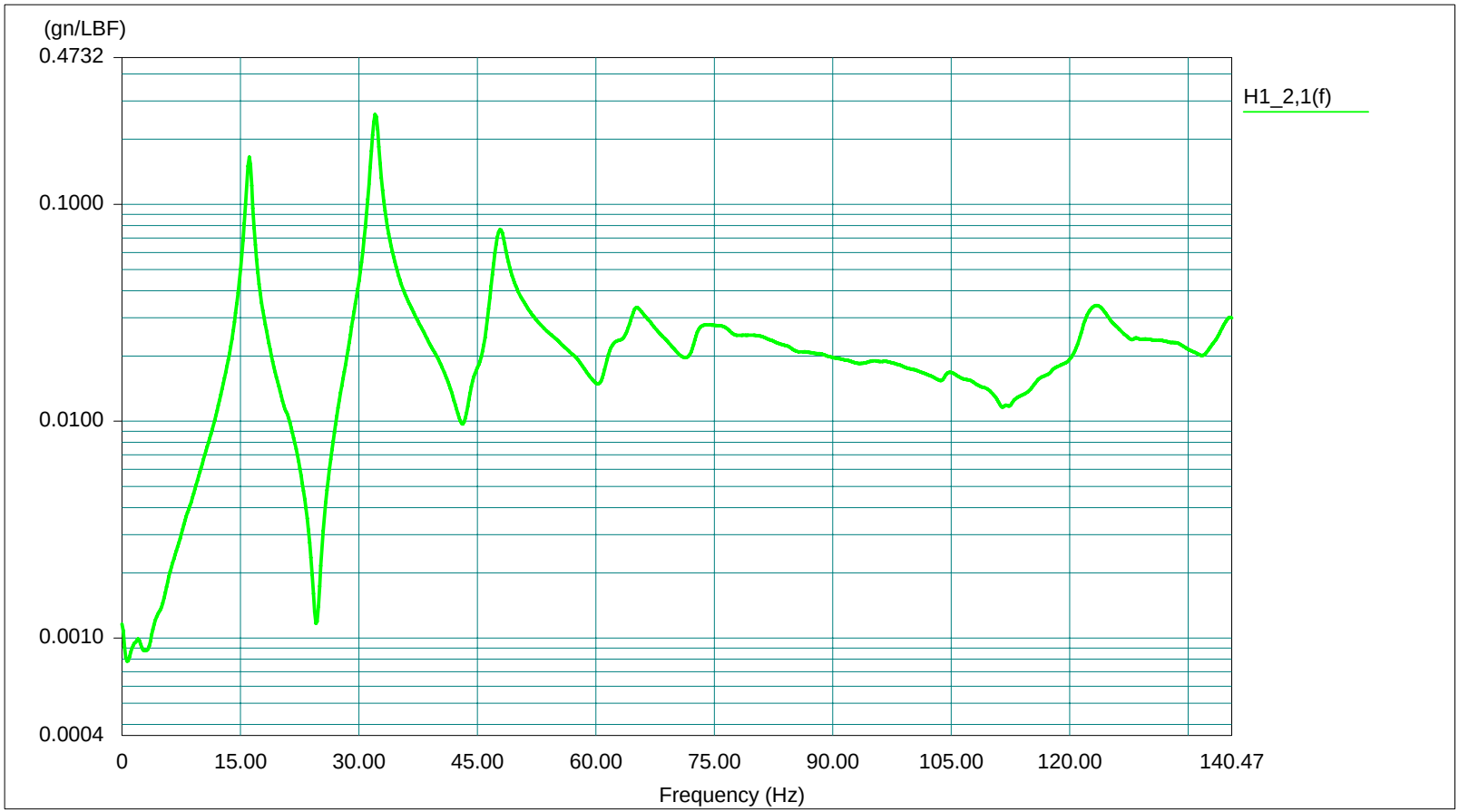
Vibration Spectrum of EBPM



29 Hz Propagating route ?

How to reduce it?

FRF of magnet assembly in horizontal direction



Vibration mapping @ 29 Hz in the ring

	Location	Distance from source (M)	Acceleration (m/sec*2)	
1	Utility Chiller stand	0	1exp -2	
2	Ground near chiller	2	4exp-3	
3	Ground of 1st utility building	20	1exp-3	
4	Ground of SR building near utility	40	3exp-4	
5	Ground near control room	60	3exp-4	
6	Ground of X-ray BL (Near middle)	60	2exp-3	
7	Ground of X-ray BL(near SR)	65	1exp-3	
8	Ground of BL01	95	5exp-4	
9	Ground of BL 04	110	2exp-4	
10	Ground of BL08	120	2exp-4	
11	Ground of Entrance	130	3exp-4	
12	DIW pipe R4 trench	100	4exp-3	
13	Ground of R4	90	1exp-4	
14	R4 Quad Magnet	90	3exp-4	

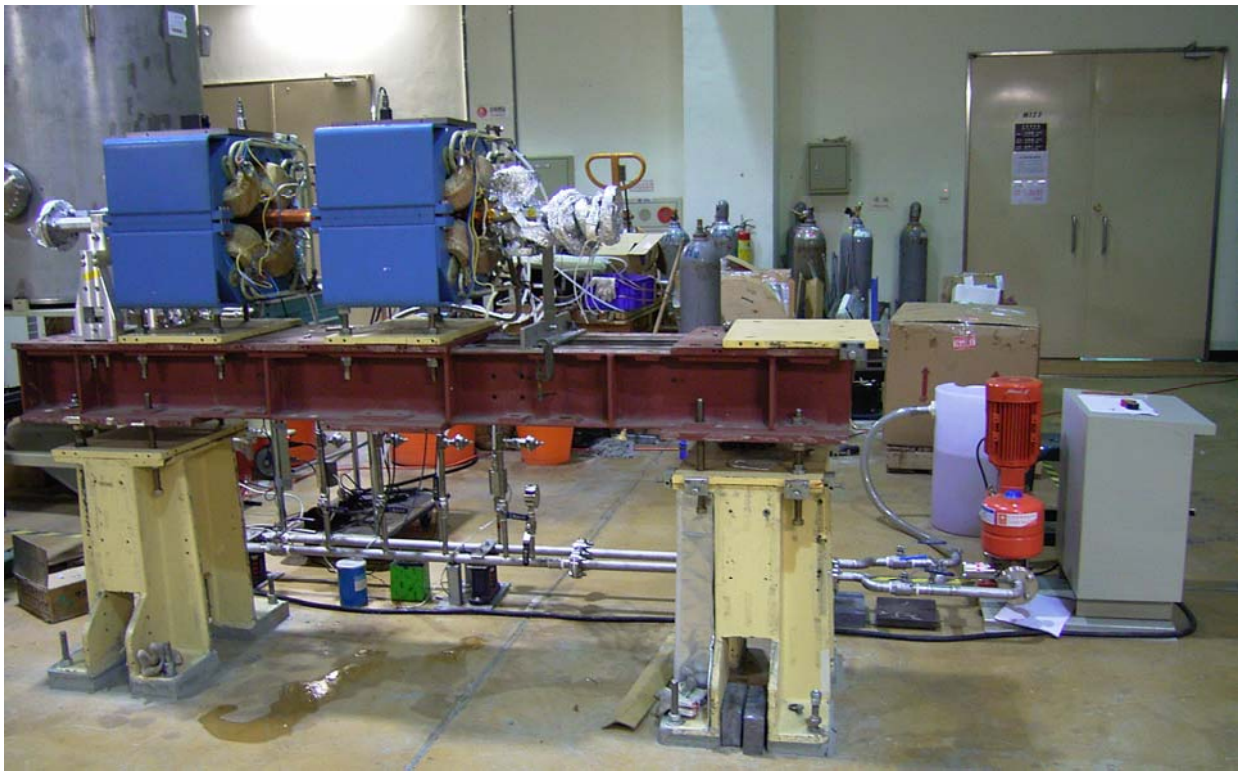
Improvement in the ring

	Ring Ground	R3BPM 5X	R3BPM 5Y	R5Q5 vertical	R6Q5 vertical
Before	**3.7-20nm**	**0.22um**	**0.34um**	**27nm**	**24nm**
After	**3-12nm**	**0.1um**	**0.14um**	**3.3nm**	**4.5nm**

Flow test station

1. What is net flow vibration ?
2 Chamber flow versus magnet flow.
3. What will be excited by water flow?
4. Valve effect.

Experimental set-up



Purpose:

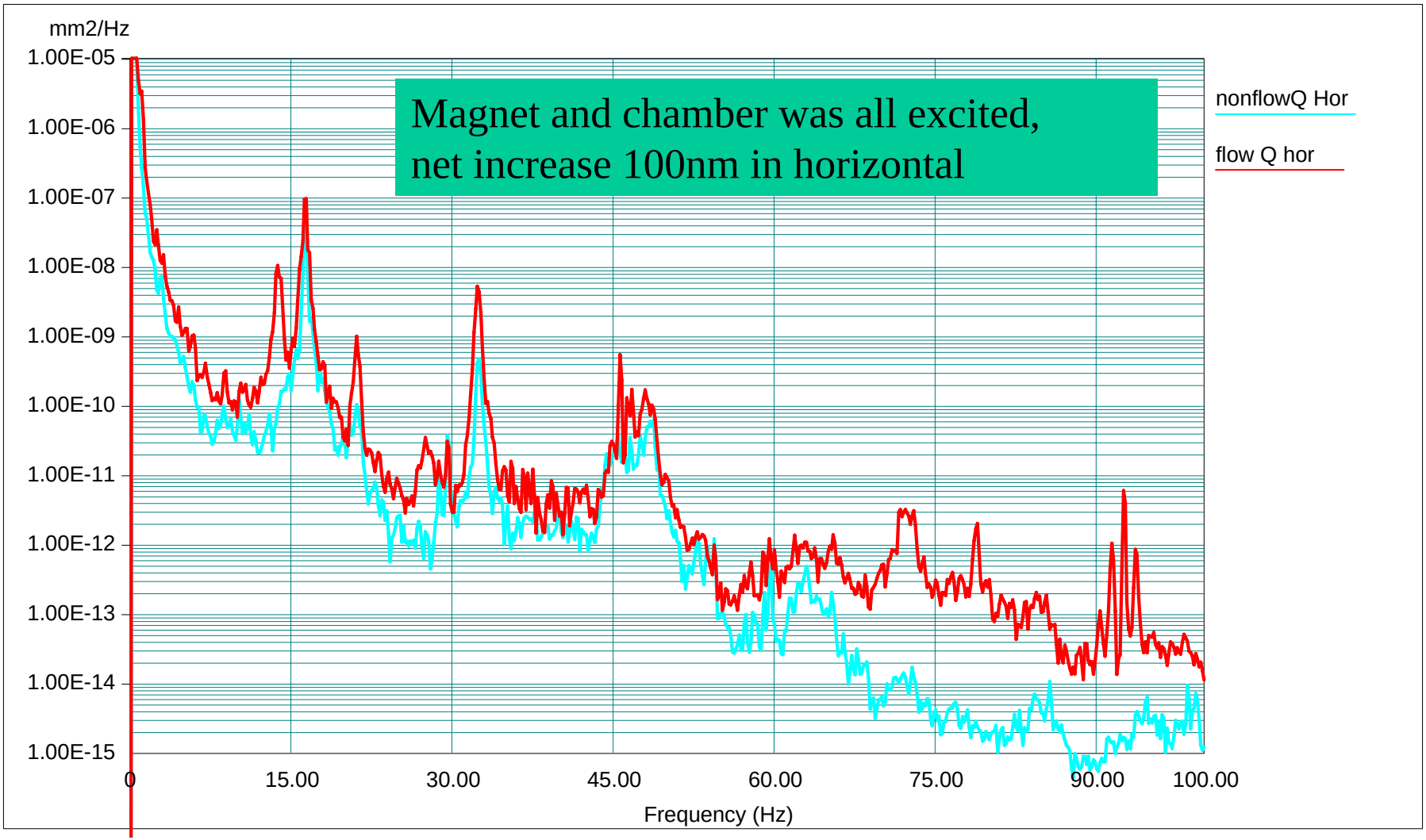
1.To simplify coupling

2.Flexible test condition

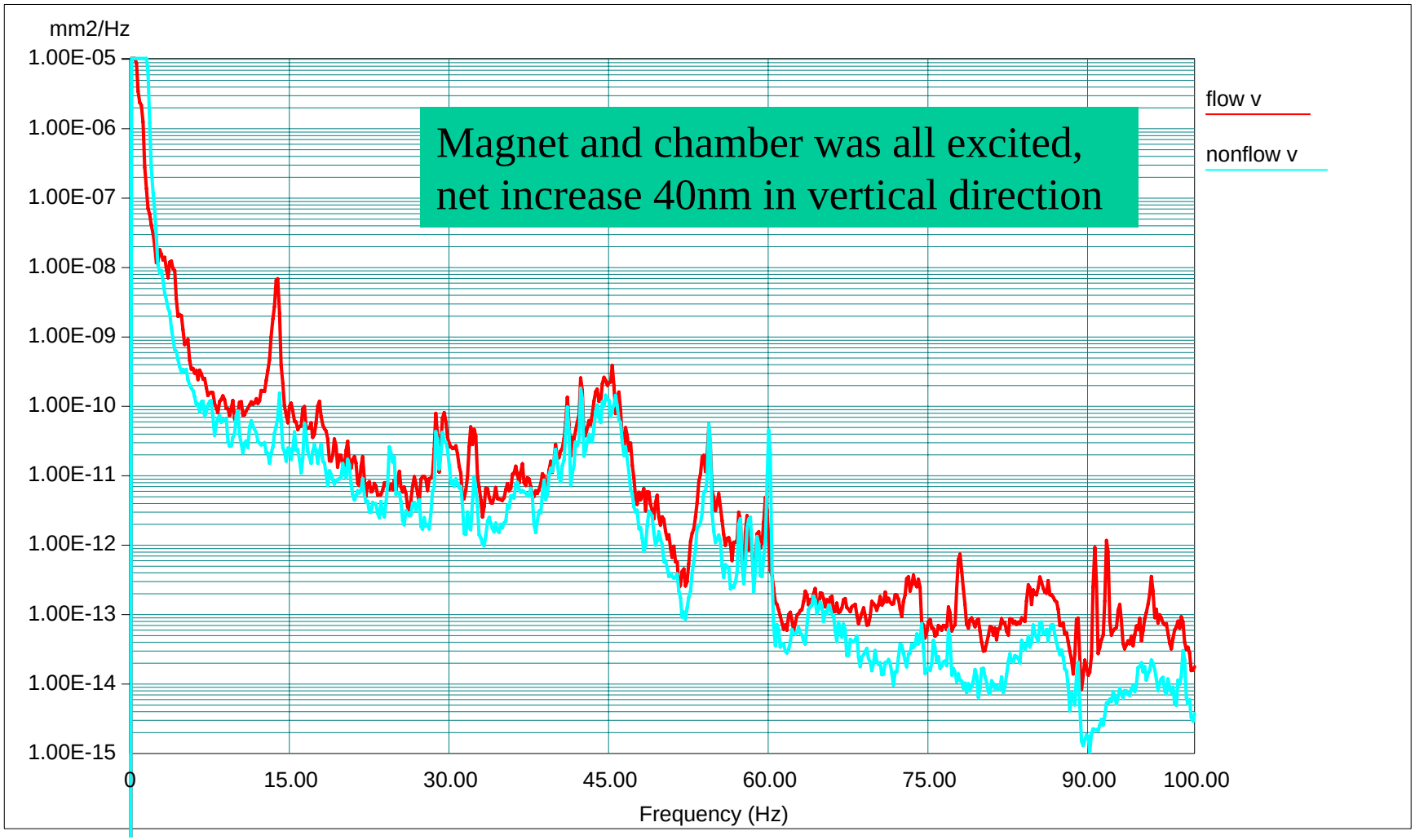
Measurement

1. LDS spectrum analyser.
2. PCB 393 B12 accelerometer.
2. PSD measurement
3. Integrate from 10 to100 Hz and take square root to give displacement.
4. Signal processing was calibrated by HP function generator.

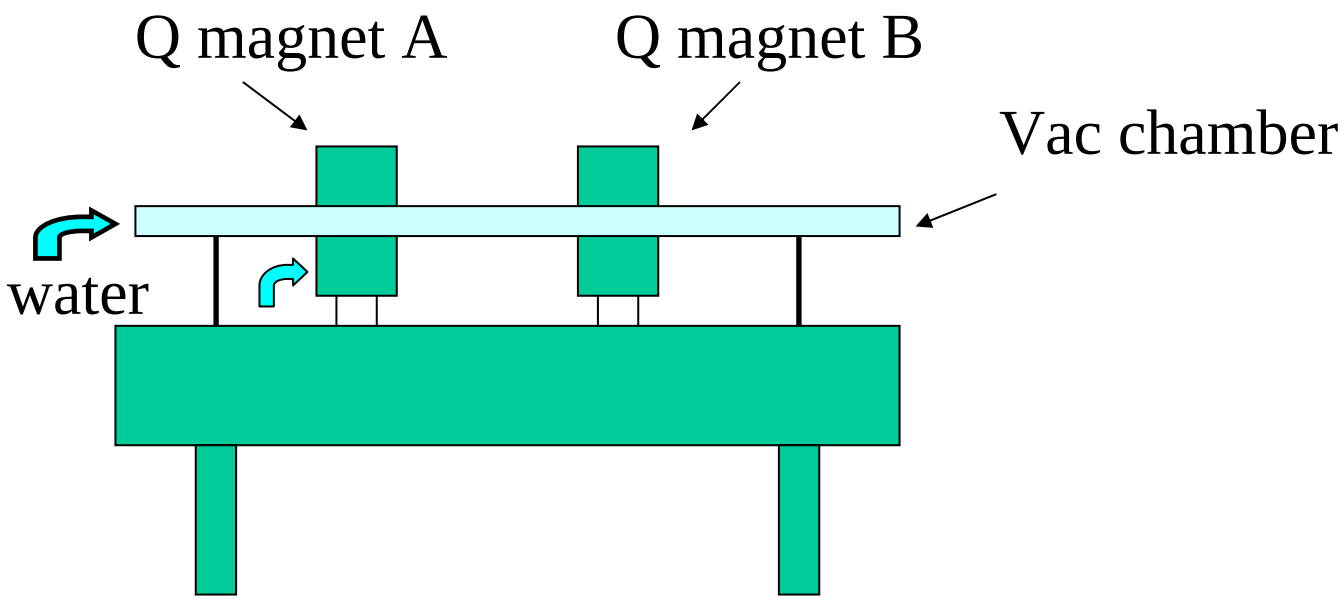
Q1 horizontal, flow versus no flow
pump on versus pump off



Q1 vertical, flow versus no flow
pump on versus pump off



Water vibration coupling between chamber and magnet

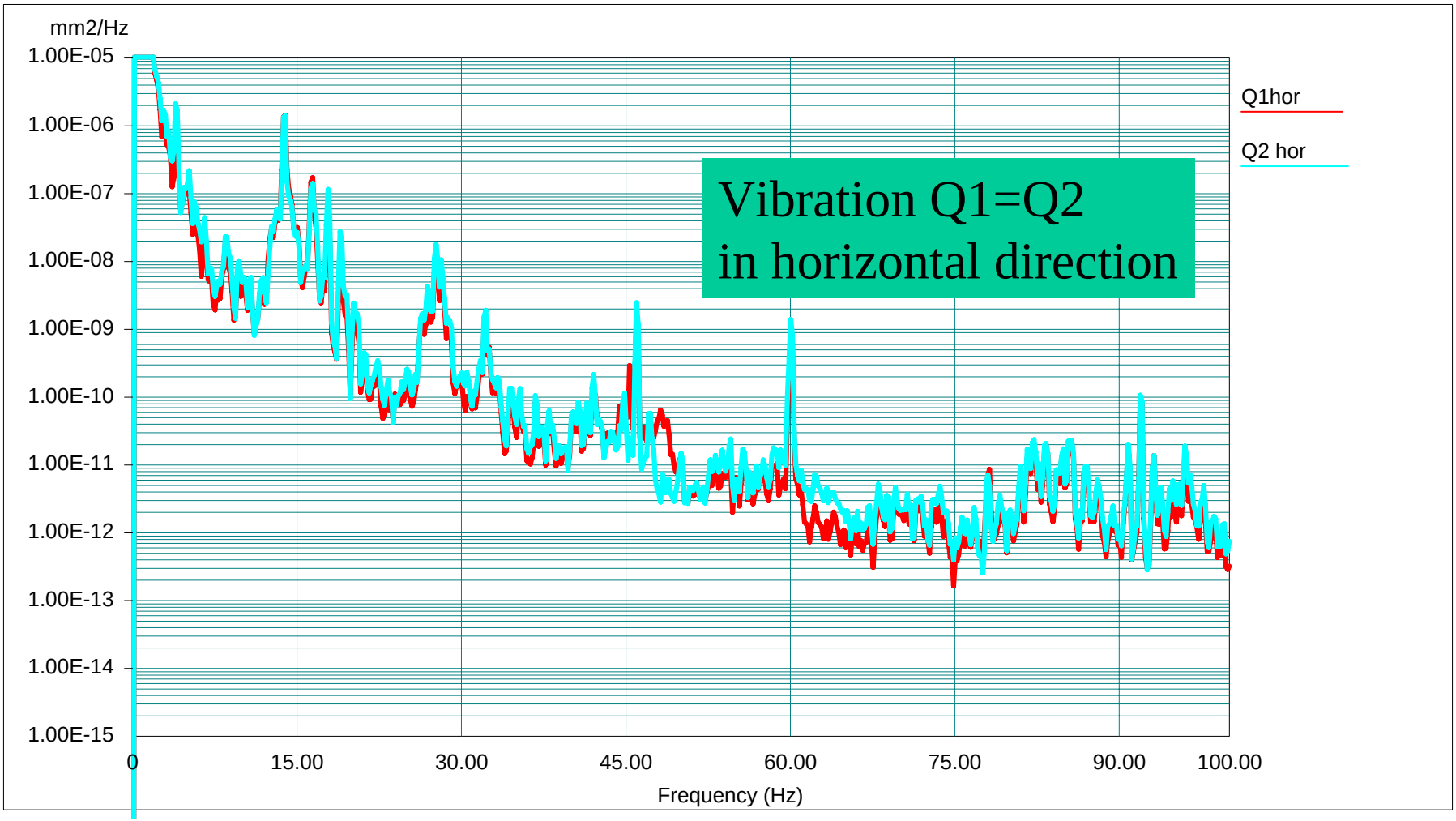


1. Q magnet A flow only, vibration QA = QB.
2. Chamber flow only, vibration QA = QB.

⇩

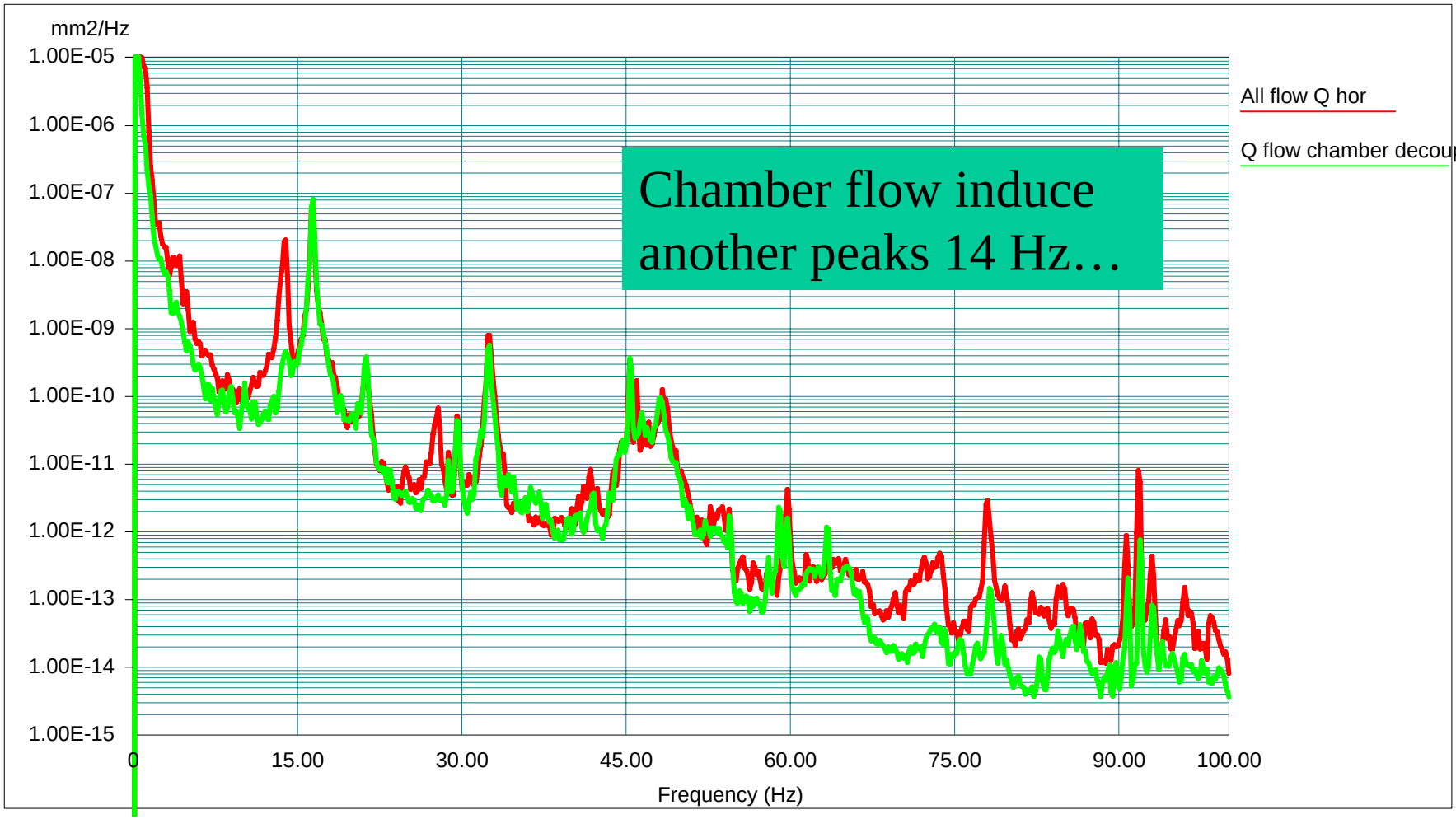
Strong coupling by the same girder.

Chamber flow, Q1 flow, Q2 no flow



Rigidly mount，highly coupling

Chamber flow versus chamber decoupling



Chamber decouple reduce 50 nm in horizontal,

30 nm in vertical

Summary of flow station test

	Condition	Q magnet hor	Q magnet ver
1	Pump off Magnet, chamber water pipe normal link	115 nm	29 nm
2	Pump on Magnet, chamber water flow	222	71
3	Pump on Magnet water flow, chamber pipe decouple	177	40
4	Pump on Magnet water flow, chamber close valve	225	73
5	Pump off Magnet pipe link, chamber pipe decouple	170	36

Summary

1. Water flow in turbulence region behaved as a random vibration source to excite the natural frequency of components.
2. Flow-induced vibration in the chamber and magnets are easy to cross talk if they sit on the same girder.
3. Valve is a potential vibration source in the partial-opening and closed condition.
4. A damping scheme by using rubber pipe to reduce the vibration transmission along pipe had positive result in the storage ring magnet.