# The Result of the Vibration Measurement for the SPring-8 Storage Ring

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## 1. Introduction

Since effects of vibration on electron beams of the third generation synchrotron radiation sources are more serious than the first or the second generation synchrotron radiation sources, it is important to measure the vibration and evaluate the effects on the electron beam before machine operation.

Therefore we measured the vibration in the storage ring to understand vibration condition for whole ring. Measurements items are as follows:

1)Characteristics of vibration transfer from source points in electrical/mechanical building to machine tunnel.

2)Vibration amplitude of machine tunnel.

3)Vibration amplitude and modes of magnets.

## 2. Measurements

*2-1 Characteristics of Vibration transfer from source points in electrical/mechanical building to machine tunnel.*

Characteristics of vibration transfer were measured from source points (two cooling water pumps and a refrigerator machine) in C zone mechanical building to machine tunnel. Measurements points are on the base of pumps and refrigerator machine, on the floor under the pumps, floor of maintenance passage and floor of machine tunnel. (Fig.1) Measurement directions are NS(north-south), EW(east-west) and V(vertical).

*2-2 Vibration amplitude of machine tunnel.*

Vibration amplitude on floor in machine tunnel was measured. Measurement points are 17 points and measurement directions are X,Y,S. Measurements were made for two cases: cooling system operated and not operated.

*2-3 Vibration amplitude and modes of magnets.*

All magnets of cell#28, which is near the source points, and cell#33, which is far from the source points, were measured. Accelerometers were set on the top of magnets. Measurements were made for two cases: cooling water flowing in the magnets and not flowing. Measurement directions are X,Y,S.

Modes of vibration for girders (base of magnets) and magnets using impact hammer method were analyzed.

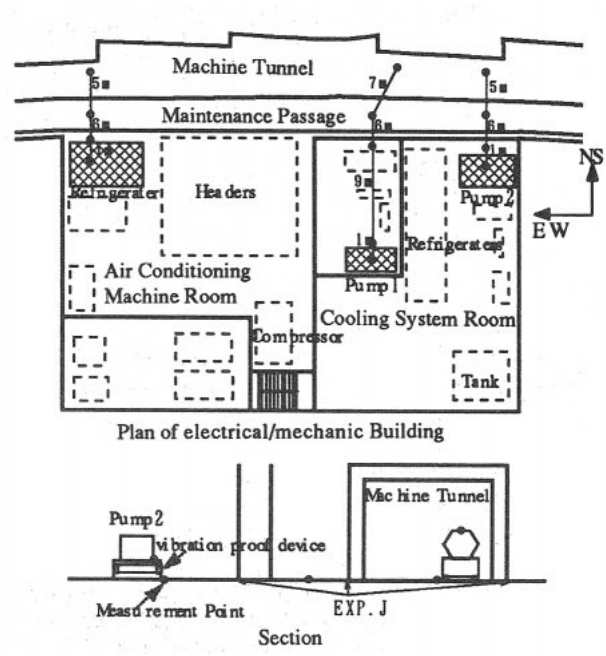


Fig.1 Measurement points

## 3. Results

*3-1 Characteristics of Vibration transfer from source points in electrical/mechanical building to machine tunnel.*

Main frequencies transferred from electrical /mechanical building to the machine tunnel are 29.75, 59.5 and 89.5 Hz. The vibration amplitude decreases as the distance from the source point to the measurement point increases. (see Fig.2)

*3-2 Vibration amplitude of machine tunnel.*

The maximum vibration amplitude 3nm is measured at the nearest point to the electrical /mechanical building. For almost all the area amplitudes are less than 1nm. (see Fig.3)

*3-3 Vibration amplitude and modes of magnets.*

The maximum vibration amplitude for X direction is decided by bending vibration mode of magnet. This characteristic frequency is approximately 20Hz. The maximum vibration amplitude of magnet is 40nm and average amplitude is 10~20 nm for X direction.

The maximum vibration amplitude for Y direction is decided by vibration mode of girder.

The vibration amplitude of Y direction for the magnets on A and C girders are less than 10nm and for the magnets on B girder maximum amplitude is 45nm at cell#28. These amplitudes decrease as the distance from the source points increases and at the farthest cell#33, it is less than 5nm.

(see Fig.4 and Fig.5)

## 4. Conclusion

Vibration amplitudes of magnets are less than 0.1 μm in all directions. Although emittance is sensitive to vibration of Y direction, as the maximum amplitude of Y direction is decided by mode of girder, the influence is smaller than when the maximum is decided by the magnet itself.

Therefore, it is considered that the influence of vibration on electron beam is small.

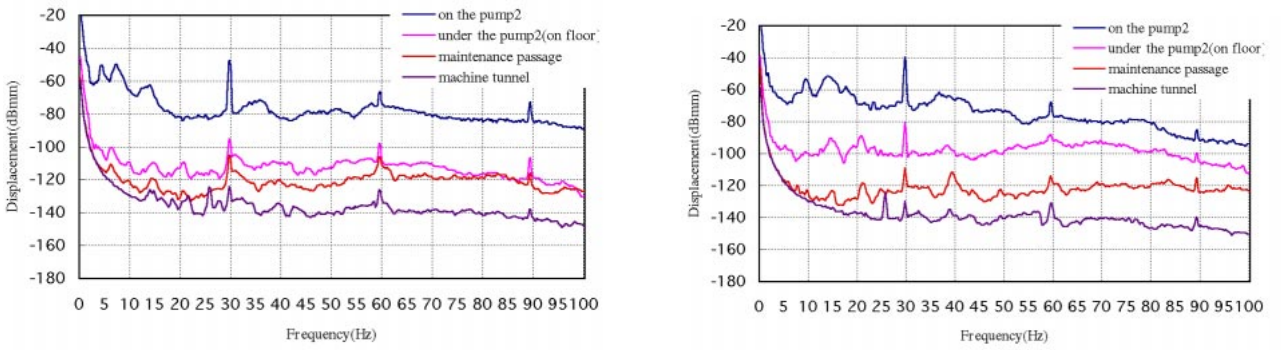


Fig.2 Vibration transfer from source points in electrical/mechanical building to machine tunnel

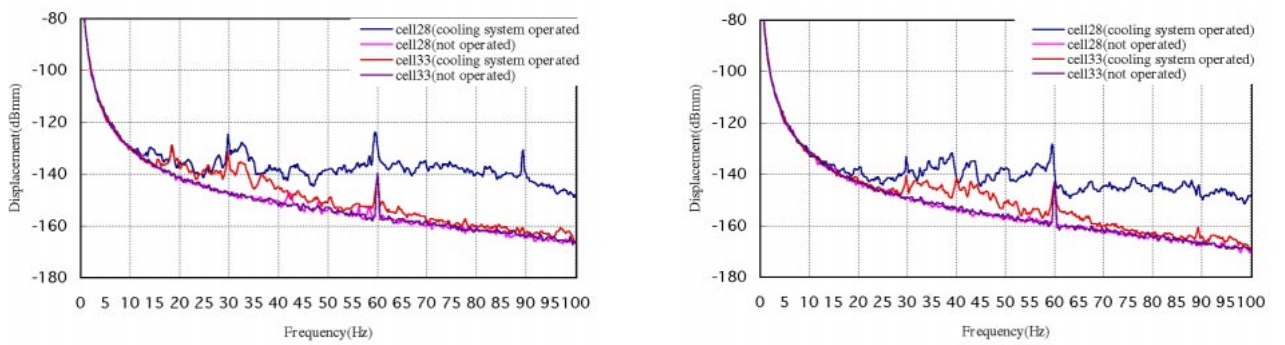


Fig.3 Vibration amplitude of the floor near the cell#28 and cell#33

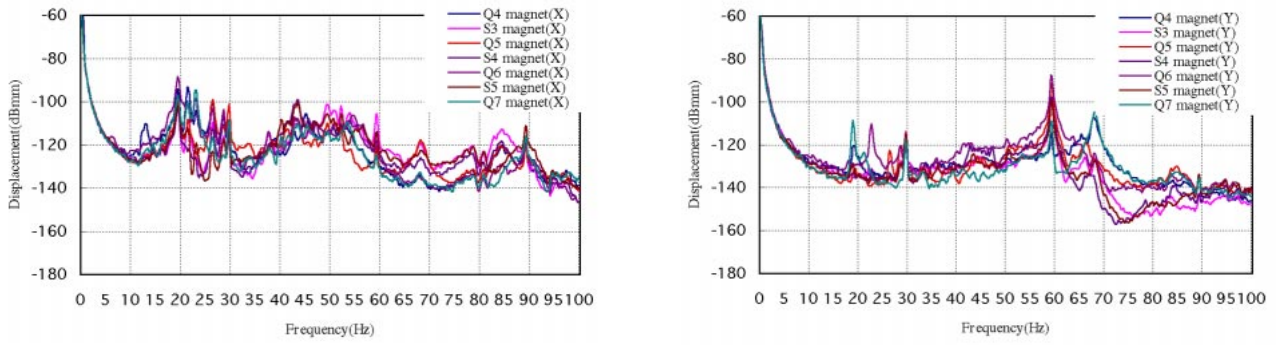


Fig.4 Vibration amplitude of magnets on B type girder at cell#28(near the source points)

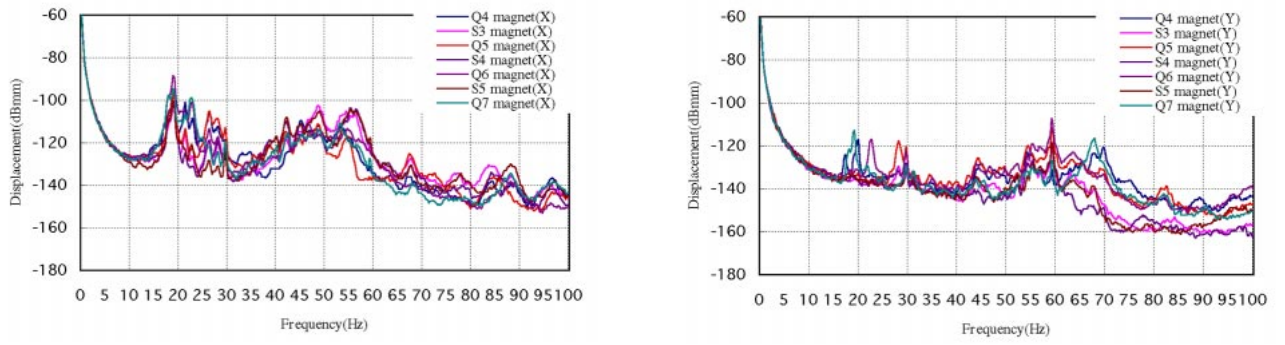


Fig.5 Vibration amplitude of magnets on B type girder at cell#33(far from the source points)