



**Project for
Orbit Stabilization
in SPring-8 Storage Ring**

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Outline of the Talk

- **Motivation and Target**
- **Review of the Orbit Stabilization Activity**
- **Present Status**
- **Toward the Ultimately Stable Beam**

Motivation

- **Stable and Brilliant Photon Beam Generation (3rd gen. SR)**
- **Spatial Coherent X-ray Generation (Linac based SASE, 4th gen. SR)**
- **Extremely Precise Beam Control (Linear collider, B-factory, etc)**

Target

Stability : sub-micron

→ ~100 nm

→ DC < Freq. range

< several 100 Hz

Time Schedule: fruits

within 2 years

Review of the Activities

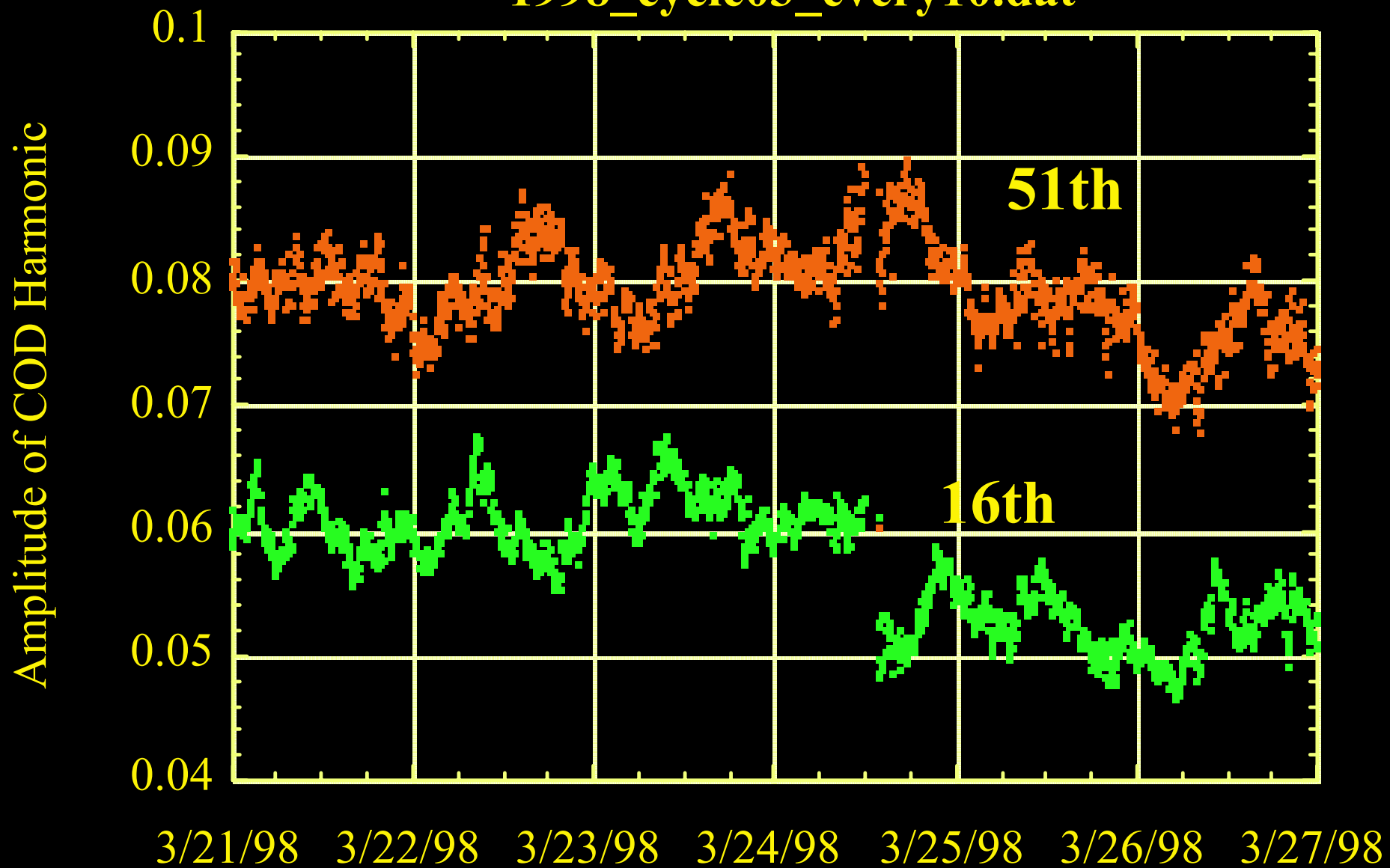
Strategy in accelerator design:

Thought-out suppression of causes based on operating SR's, especially KEK-PF

→ Stable beam users can stand from the beginning of operation

→ Source buster through the user operation

1998_cycle03_every10.dat





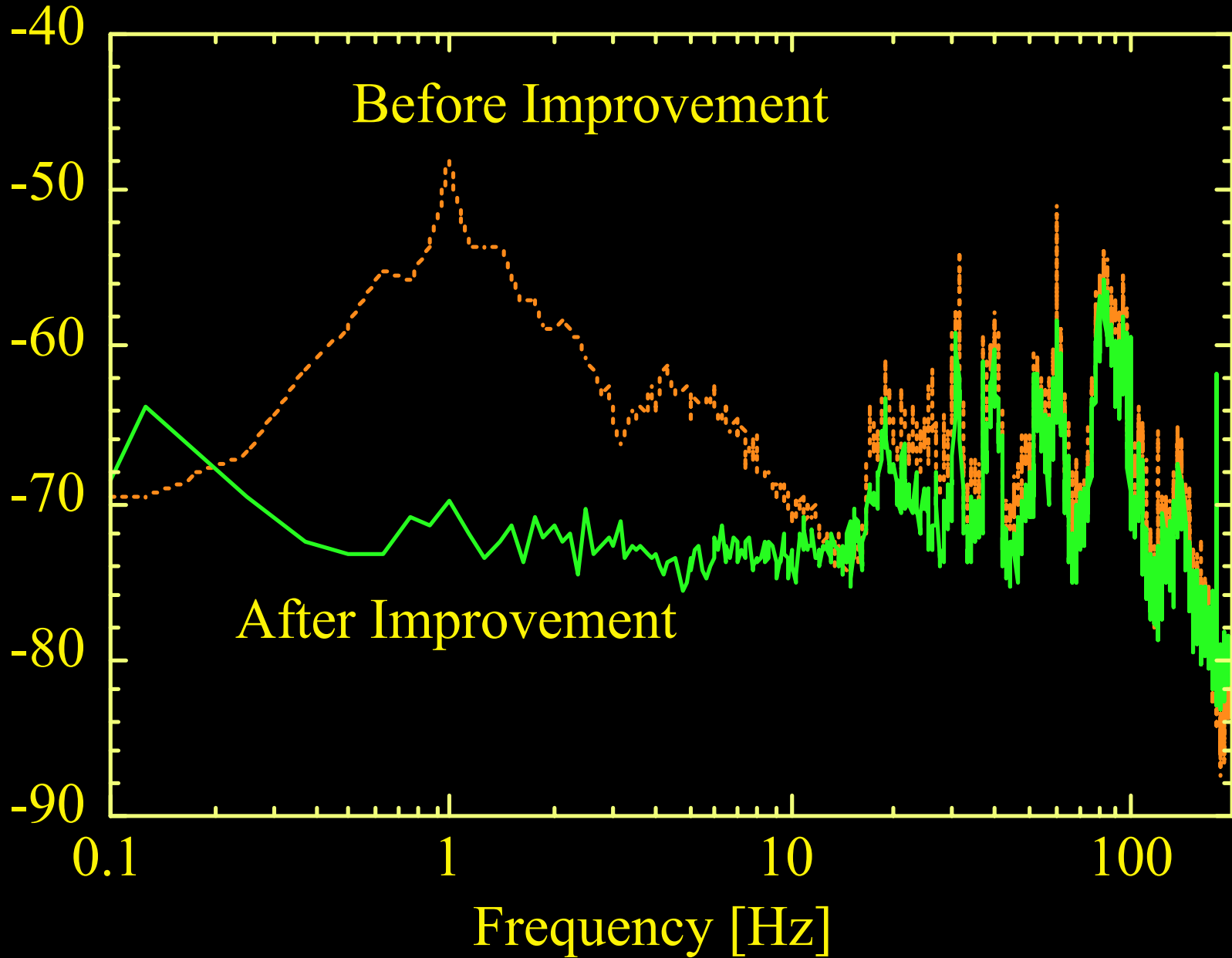
Fast ($\sim 0.5\text{Hz} \sim \text{several kHz}$)

97'~01: Correction of ID gap & ϕ dependent orbit shift (16/Aft/K.Nakatani)

00'~01: Suppression of main magnet PS current ripple (15/Aft/H.Takebe)

00'~01: Suppression of coherent synchrotron oscillation (16/Aft/T.Ohshima)

Spectrum Density of Horizontal Beam Orbit
Measured at Cell#39 [dV/Br]





Slow (Lower than $\sim 0.5\text{Hz}$)

97'_{autumn}: Conservation of thermal equilibrium

97' : Improvement on temperature control
of cooling water ($\Delta T < 0.3^\circ\text{C}$)
(16/Aft/K.Kumagai)

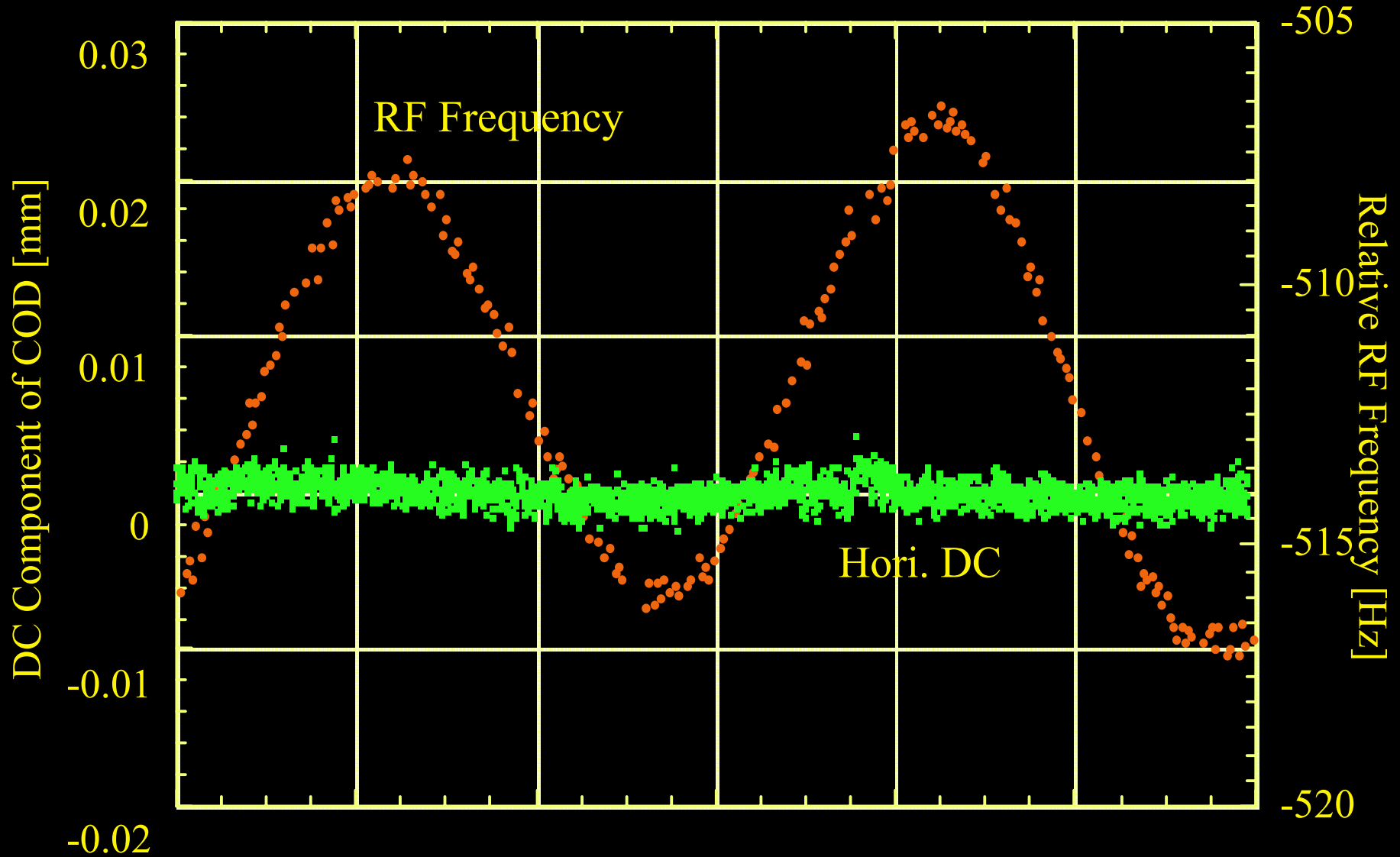
98'~01: Auto-correction of orbit drift ($< 0.01\text{Hz}$)

98'_{winter} : Correction of interference between
chamber and magnet (K.Kumagai)

99'~01: Correction of circumference variation

99'~01: Reduction of BPM noise
(16/Aft/S.Sasaki)

One Day Variation of Circumference



Present Status

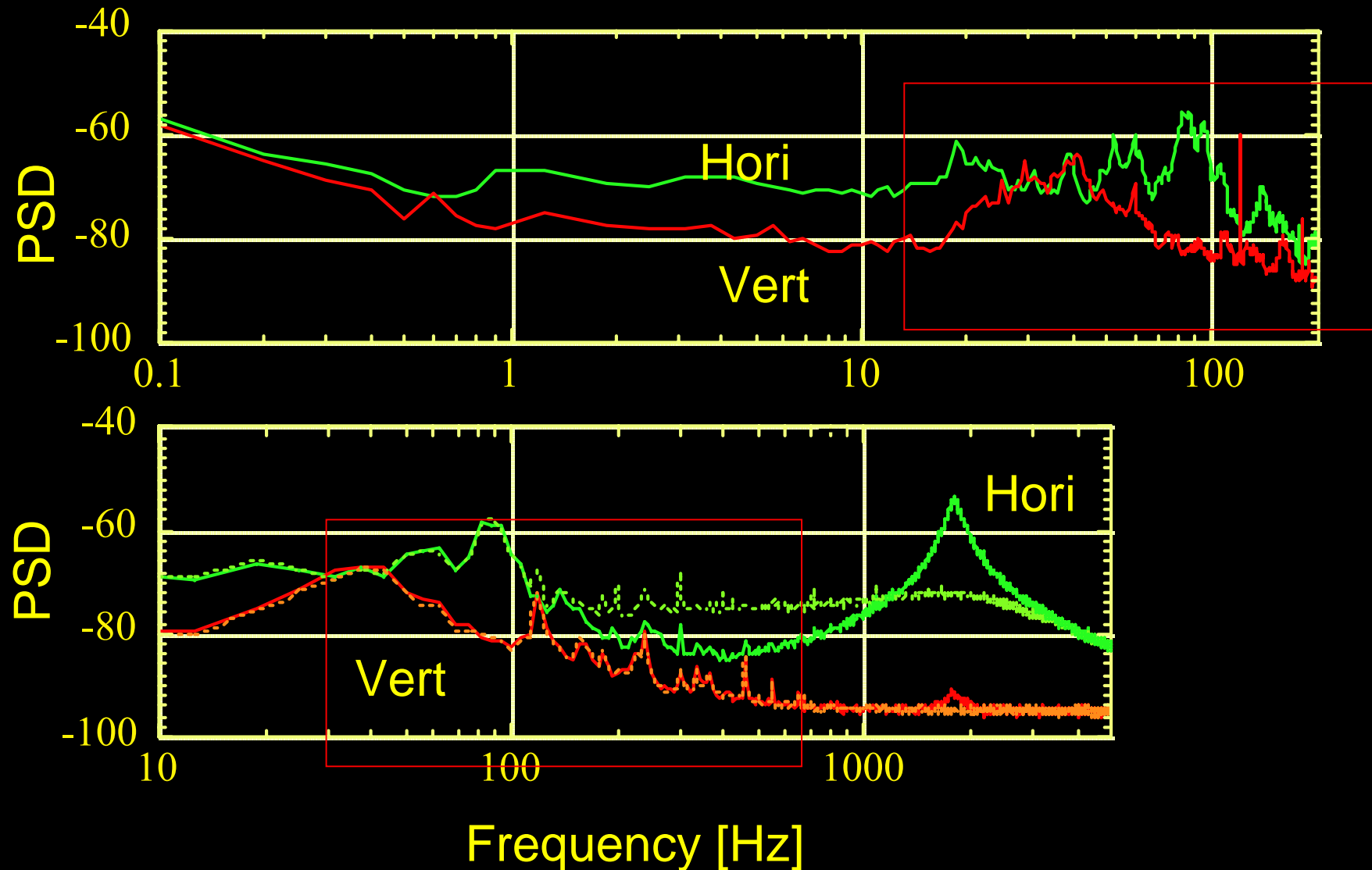
Fast (~0.5Hz ~ several kHz)

pp. 20 micron, rms. 3~4 micron

Slow (~0.5Hz ~ several kHz)

10~15 micron / day






Orbit Oscillation Spectrum










Sources for Orbit Variation

Fast

- ID
 - Gap, Phase 
 - Mechanical
- PS Ripple 
- Synthesizer / KLY Noise 
- Magnet System Vibration
- Stability of Steering Mag. Current
 - ID
 - Ring
- External Magnetic Field Variation
 - LEP 
 - Exp. Apparatus
- BPM Signal Noise 

Slow

- Cooling Water Temp. Variation
 - Current Dependence 
 - Mechanism
 - Time-resp. of Control
- Tidal Effects 
- Air Temp. Variation in Tunnel 
- Magnet System Thermal Equilibrium 
- Ground Water Temp./ Pressure
- Deformation of Buildings
- Current Dependent BPM Signal Drift / Mechanical Shifts
- Interference with Magnets 

Toward the Ultimate Stable Beam

- **Vibration of Magnet System and Tunnel Floor** (15/Aft/T.Nakazato, S.Matsui, K.Tsumaki)
- **Preparation of Fundamental System for Precise Measurement** (16/Aft/H.Aoyagi)
- **Preparation of Fast Orbit Feedback System** (16/Aft/S.Sasaki)

Summary

- **Presently source buster in SPring-8 storage ring seems to successfully work for the preparation of good initial operation condition.**
- **Further gain of 1 order in orbit stability just depends on the success of this project. God only knows what happens next year !!**