

# Present Status of Orbit Stabilization at SPring-8

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On behalf of SPring-8 Project Team  
for Beam Orbit Stabilization

2004/12/13

1

## 1. Progress in These Two Years

- Cycle by cycle reproduction of ID photon beam axes by XBPM **Sep'03**
- Introduction of top-up operation **May'04**
- Increment in the number of Steering magnets in SOFB (24->48) **Sep'04**

2004/12/13

2

## 2. Present Performance

### Fast orbit stab. (0.1Hz ~ 200Hz)

Hori. r.m.s. ~4 $\mu$ m @ID's H.size=360 $\mu$ m

Vert. r.m.s. ~1 $\mu$ m @ID's V.size=5~6 $\mu$ m

### Slow orbit stab. (<0.1Hz)

Hori. r.m.s. 1~2 micron / week

Vert. r.m.s. 2~3 micron / week

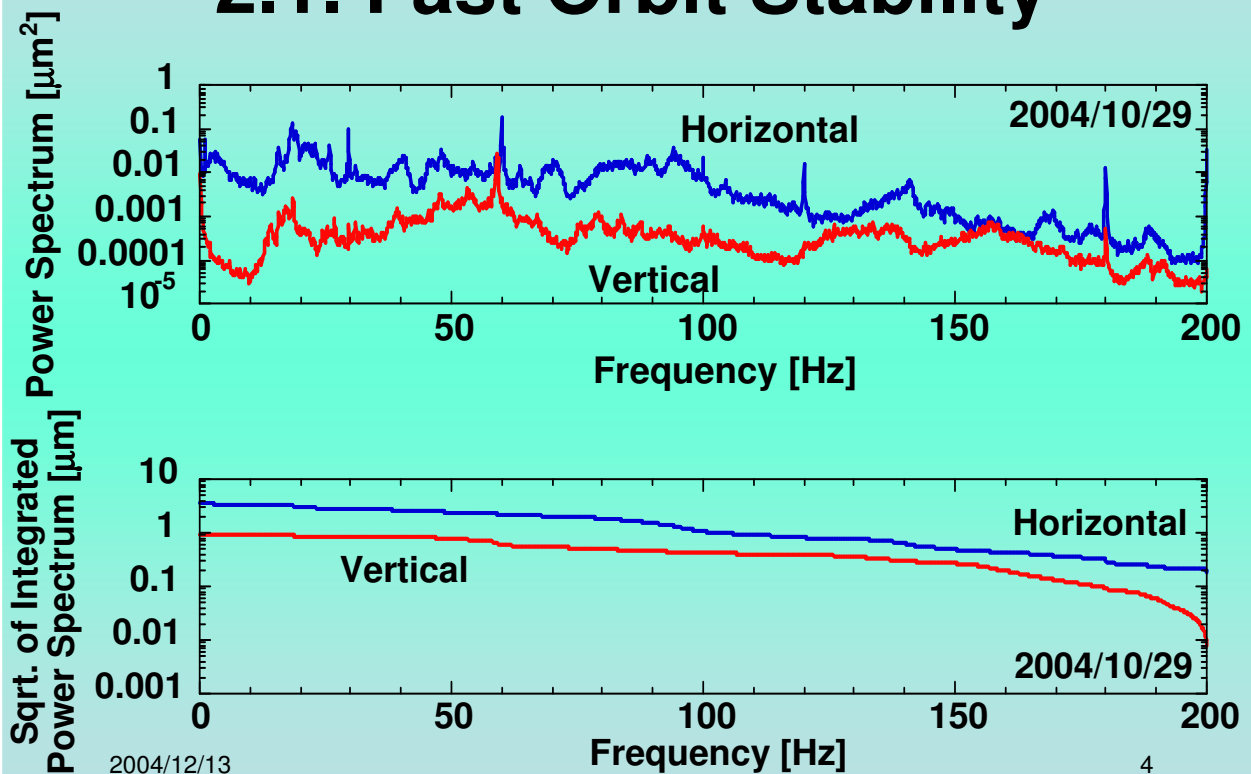
### Energy drift

~ $2 \times 10^{-5}$  (full width)

2004/12/13

3

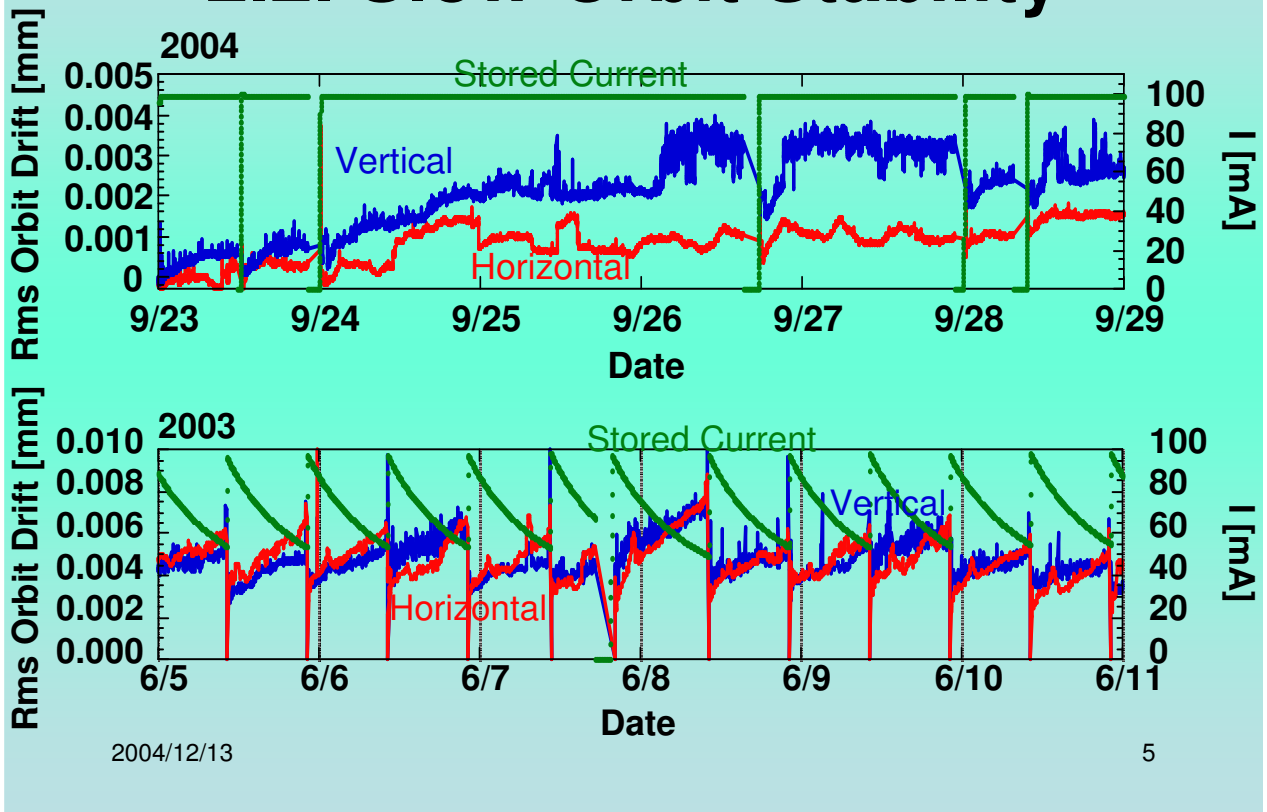
## 2.1. Fast Orbit Stability



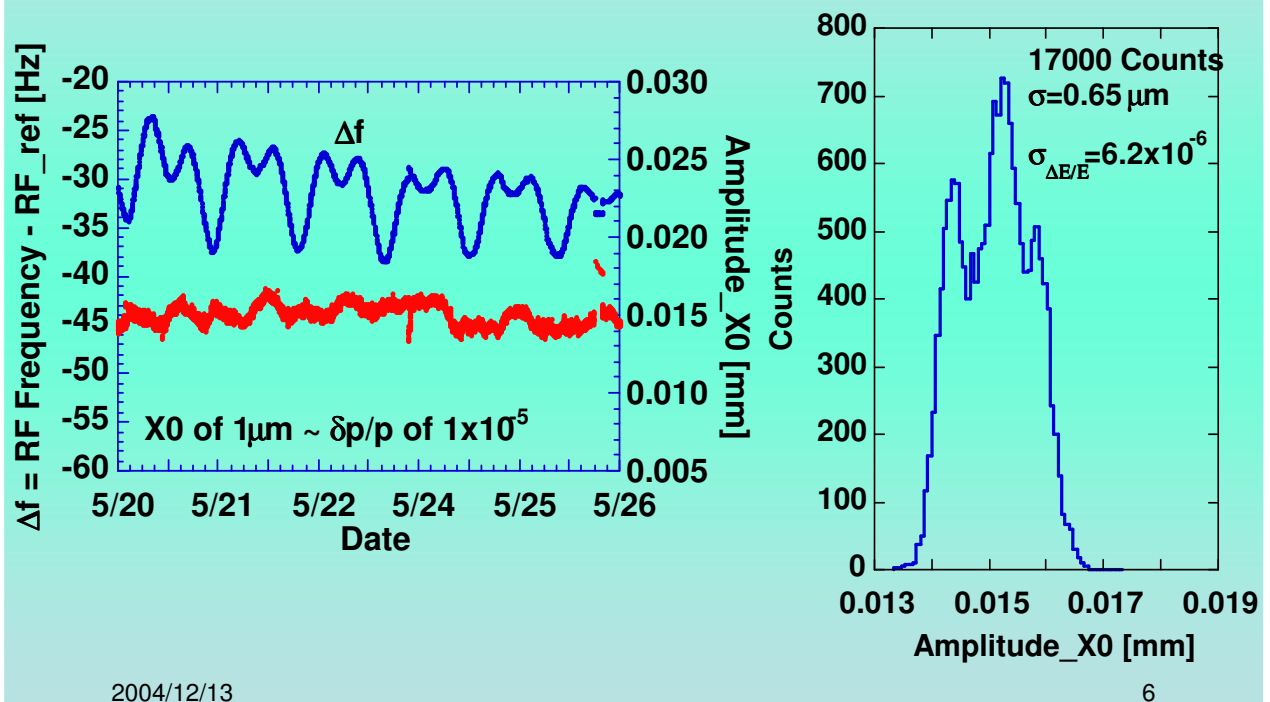
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4

## 2.2. Slow Orbit Stability



## 2.3. Beam Energy Stability



# 3. Merit of Top-up

Purpose of beam orbit stabilization

➔ **X-ray beam stabilization at experimental stations**

- Improvement of X-ray optics stability
- Reduction of current-dependent noise in beam orbit variation

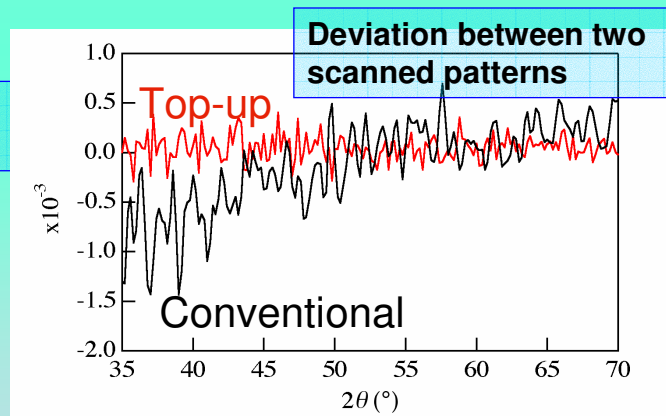
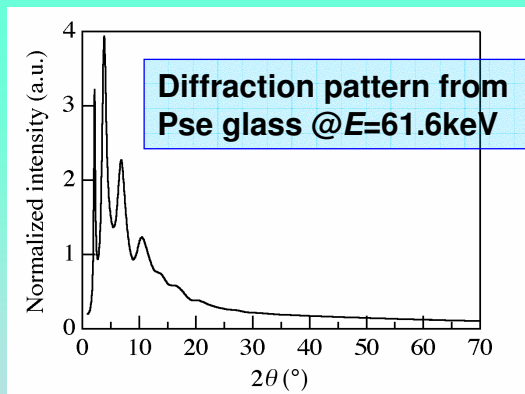
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7

# 3. Merit of Top-up (Con't)

**Example:** Quality-improvement of Diffraction Data

Diffraction data especially at higher  $2\theta$ , which need relatively large integration time, was improved in accuracy



2004/12/13

8

## 4. Facing Problems -A

### 4.1. Precise measurement of X-ray beam axes during user operation

Measured data by **XBPM** have gap and phase dependences

Measured data by **rfBPM** up- and downstream of ID have at least gap, stored current, and filling dependences

**➔ These prevent “hard correction”**

## 4. Facing Problems -A (Con't)

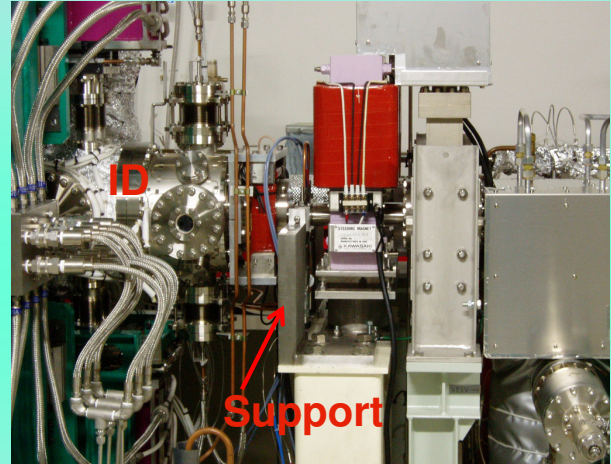
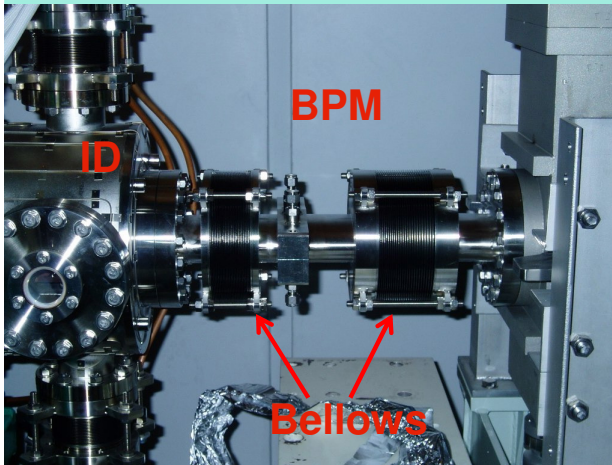
### **Counter-measures:**

**New BPM chamber with bellows and cooling channels**

**Improvement of BPM support rigidity**

**Introduction of narrow path-band filters to electric circuit (under investigation)**

## 4. Facing Problems -A (Con't)



**Beam test for global + local correction  
will start in **next year****

2004/12/13

11

## 4. Facing Problems -B

### 4.2. Clear one-day (periodic) orbit slow variation

**After introducing top-up operation,  
clear one day orbit variation appears**

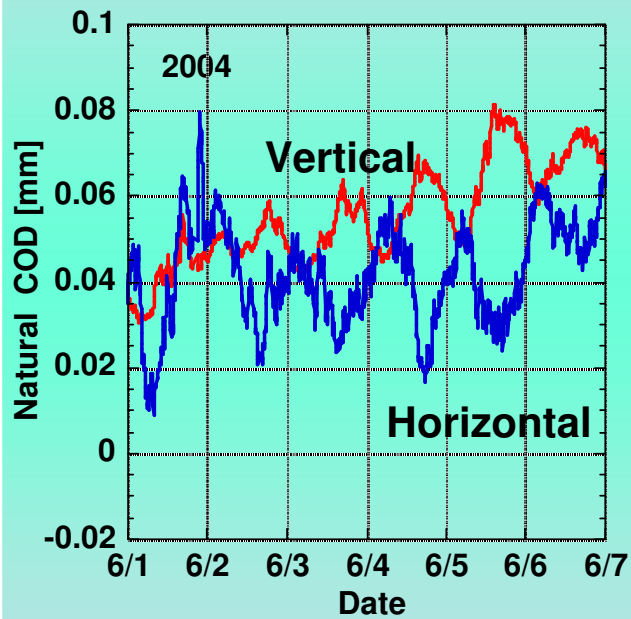
**Season-dependence**

**Strange correlation between STs**

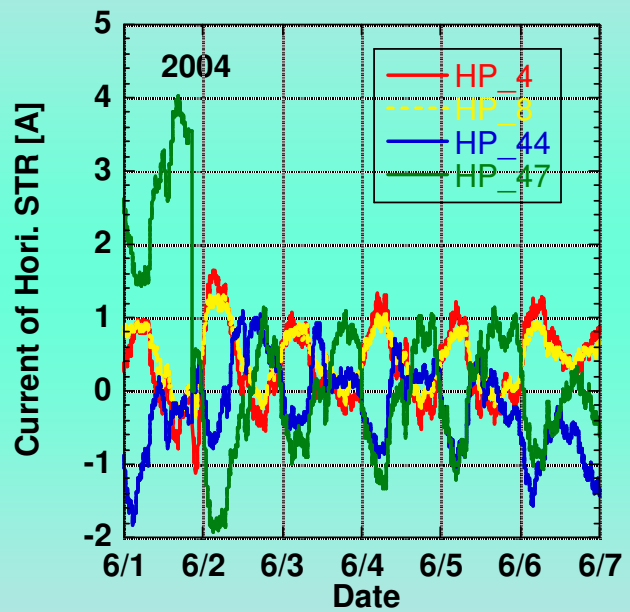
2004/12/13

12

## 4. Facing Problems -B (Con't)

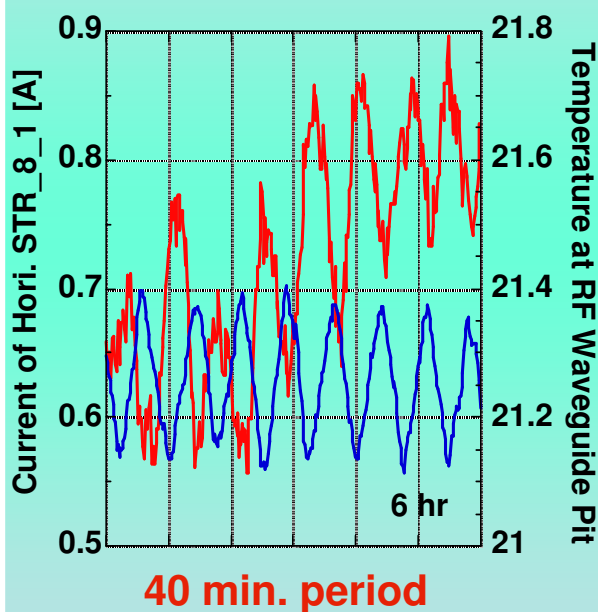


2004/12/13

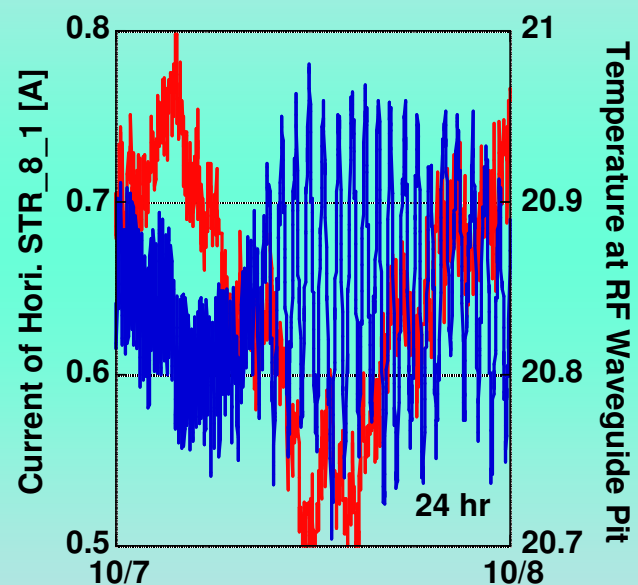


13

## 4. Facing Problems -B (Con't)



2004/12/13



14

## 4. Facing Problems -B (Con't)

We have been trying to find out these perturbation sources and mechanism of this orbit variation

**We hope to report the complete story in next IWBS**

## 4. Facing Problems -C

**Q:** Is fast orbit feedback (FOFB) necessary at SPring-8 or not ?

**A:** Although the answer depends on the mode in higher frequency regime, SOFB seems to meet the condition rather than FOFB



## **5. Summary**

**By introducing top-up operation, slow orbit drift was reduced to some extent**

**To request for further slow orbit stability, the local feedback loop will be provided BL by BL**

**We will be continue source-hunting to reduce the fast orbit variation lower than 200Hz without FOFB**