



Orbit Stabilization at SPring-8

**By H. Tanaka
on behalf of B.O.S. Project Team**

Accel.Div./JASRI/SPring-8

at IWBS2002@SPring-8 2002/12/4~6



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Outline of the Talk

- Facility Overview
- Policy & Target
- Stabilization of Fast Orbit Variation
- Stabilization of Slow Orbit Variation
- Present Performance
- Summary

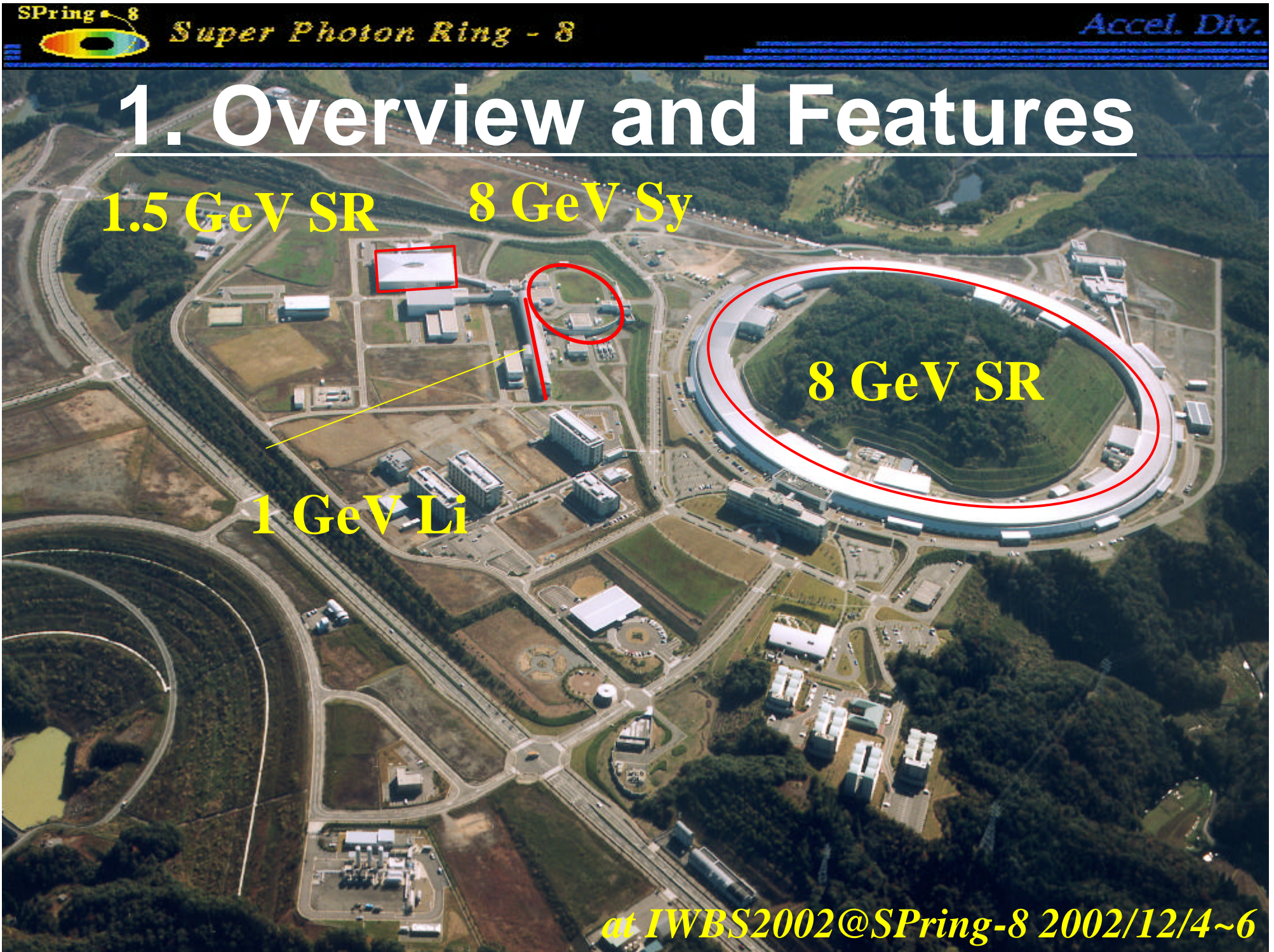
1. Overview and Features

1.5 GeV SR

8 GeV Sy

8 GeV SR

1 GeV Li





2. Policy for Stabilization

Axiom: There is no short cut.

→ Exhaustive source suppression
is only a way to ultra stability.



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3. Target

Stability : sub-micron

→ ~100 nm

→ DC < Freq. range < 200 Hz

→ This knowledge and technology
might be useful for future accelerator



4. Stabilization of F. O. V.

Fast (0.1 Hz ~ several kHz)

97'~02': Precise correction of gap & ϕ
dependent ID error fields (by ID Gr.)

00'^{winter} : Suppression of Quad. Mag. PS
current ripple I (by Takebe)

00'^{autumn}: Suppression of coherent synchrotron
oscillation

00'~02': Precise correction of ID error fields
driven by fast phase switching (by
ID Gr. and PJ team)

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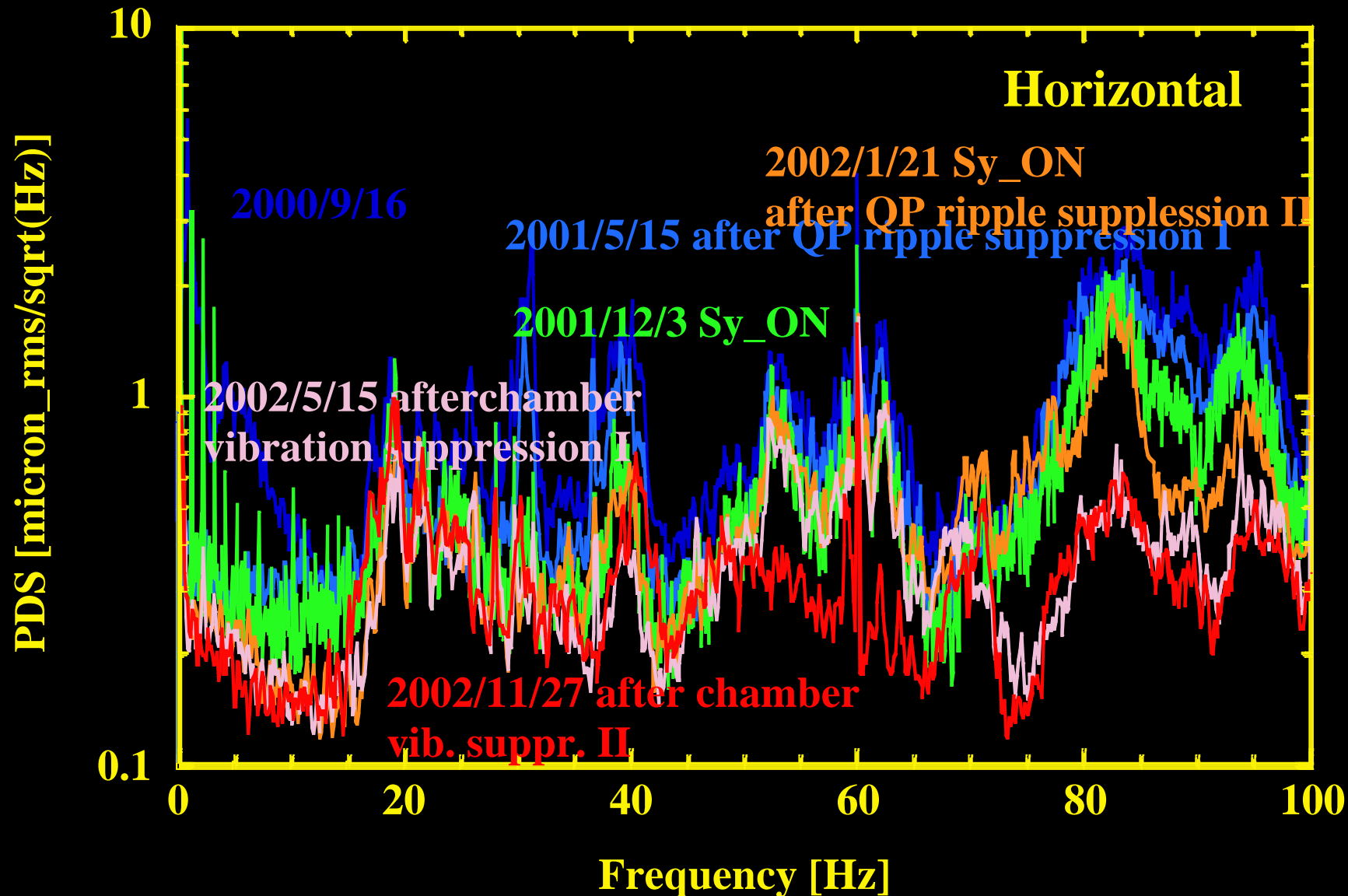
Fast (0.1 Hz ~ several kHz)

00'~01': Suppression of Quad. Mag. PS
current ripple II (by Takebe)

01'~02': Suppression of Chamber Vibration in
Quad. Mag. (by Matsui/Oishi)



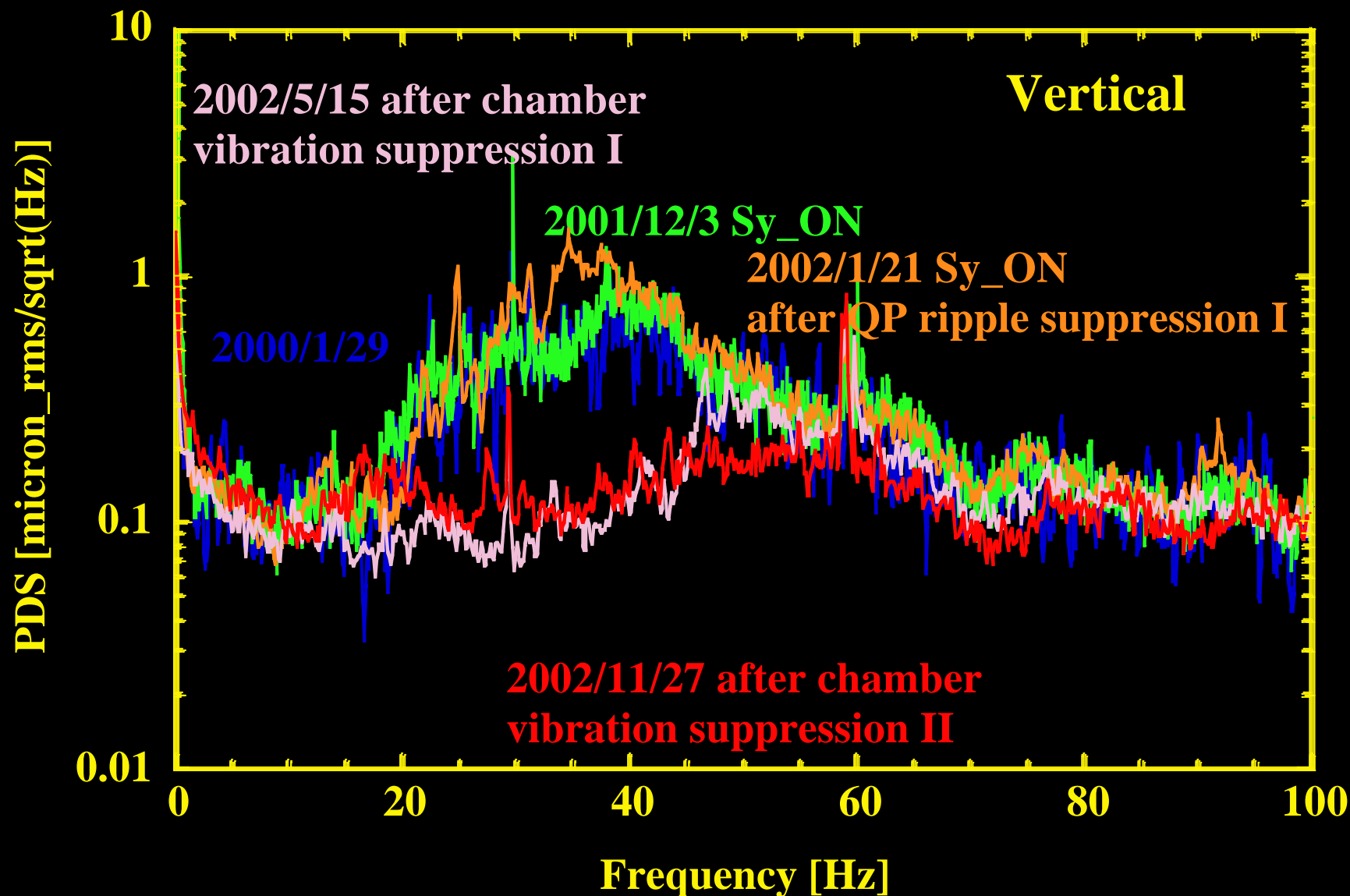
Change of Beam Spectrum (1)



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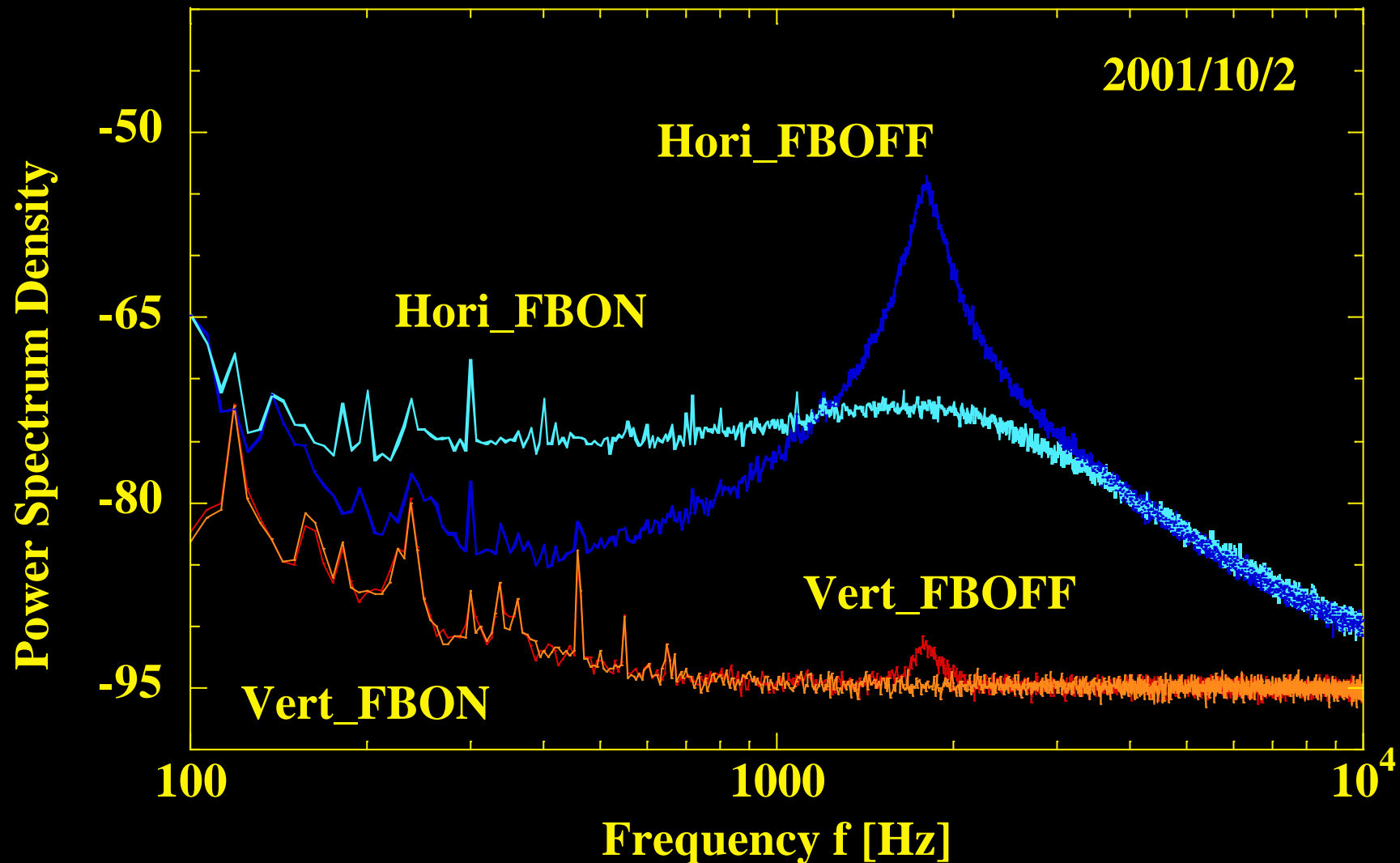
Change of Beam Spectrum (2)



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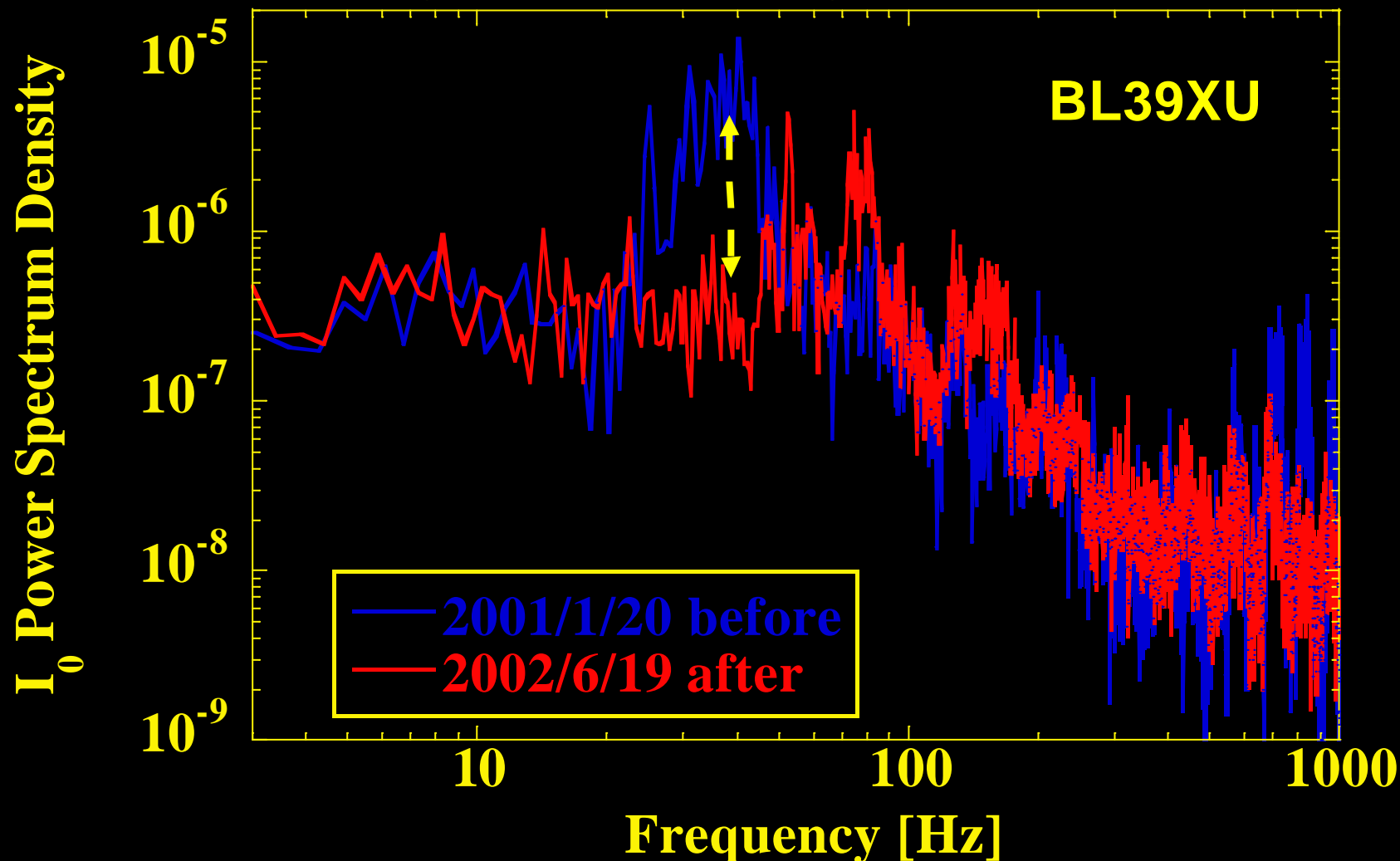


Change of Beam Spectrum (3)





Change of Monochromatized X-ray Intensity Spectrum



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5. Stabilization of S. O. V.

Slow (Lower than ~ 0.1 Hz)

97'_{autumn}: Conservation of thermal equilibrium

97' : Improvement on temperature control
of cooling water ($DT < 0.3$ C)

<< 98' Autumn , User claimed the I_0 decay differs
from I_{elec} decay >>

98'_{autumn}: Auto-correction of orbit drift (< 0.01 Hz)

98'_{winter}: Correction of chamber-magnet
interference



Slow (Lower than ~ 0.1 Hz)

<<99' Autumn, User claimed again the correction causes I_0 fluctuation.---> Investigation started >>

99'~01': **Improvement of BPM reproducibility**

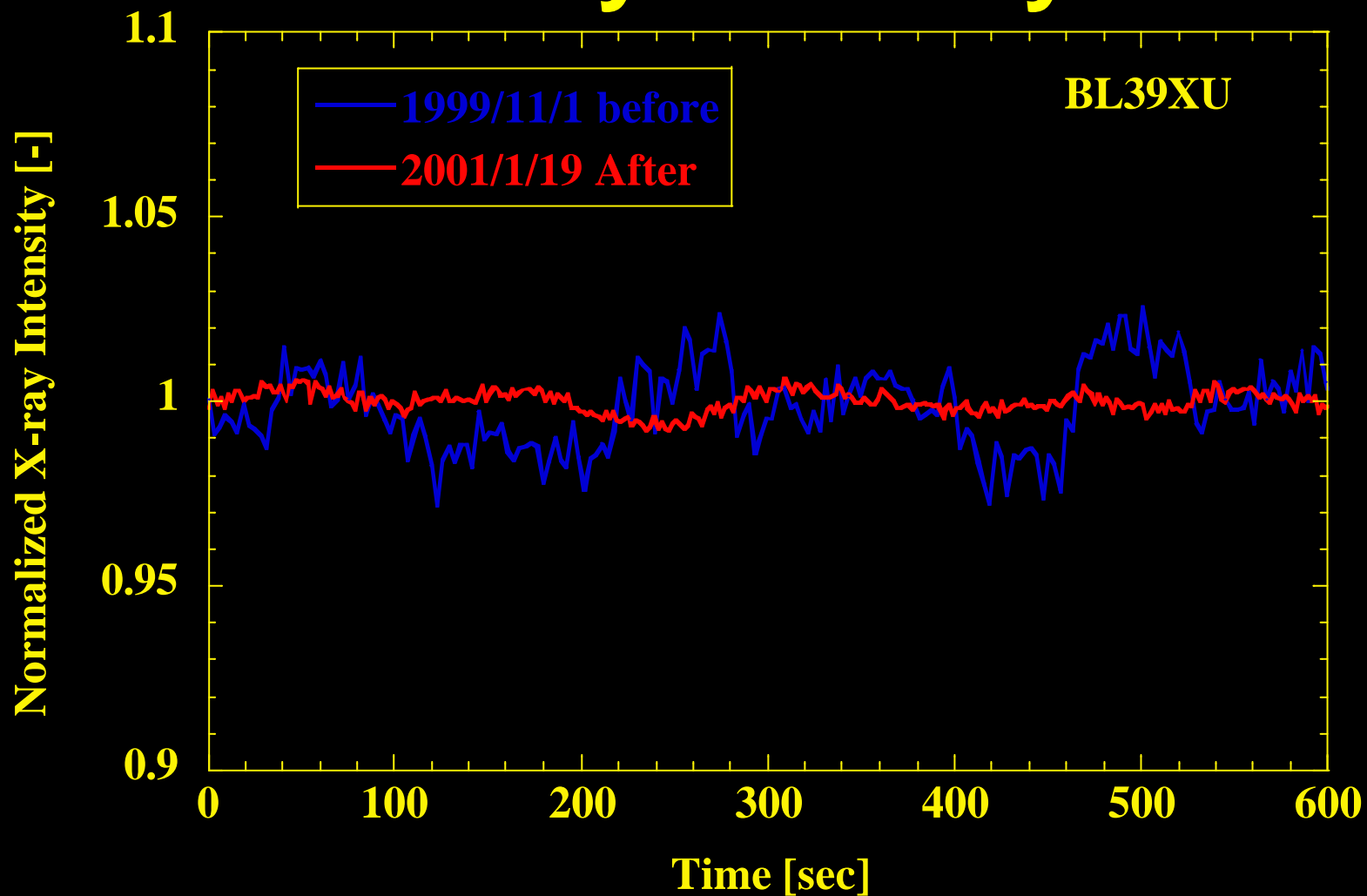
00' spring : **Installation of Steering with High Resolution & Low Hysteresis (HPST)**
(by Soutome)

<<00' Winter, I_0 fluctuation due to the correction disappeared >>

00' winter : Correction of circumference variation

02' : Increment of HPST by Double

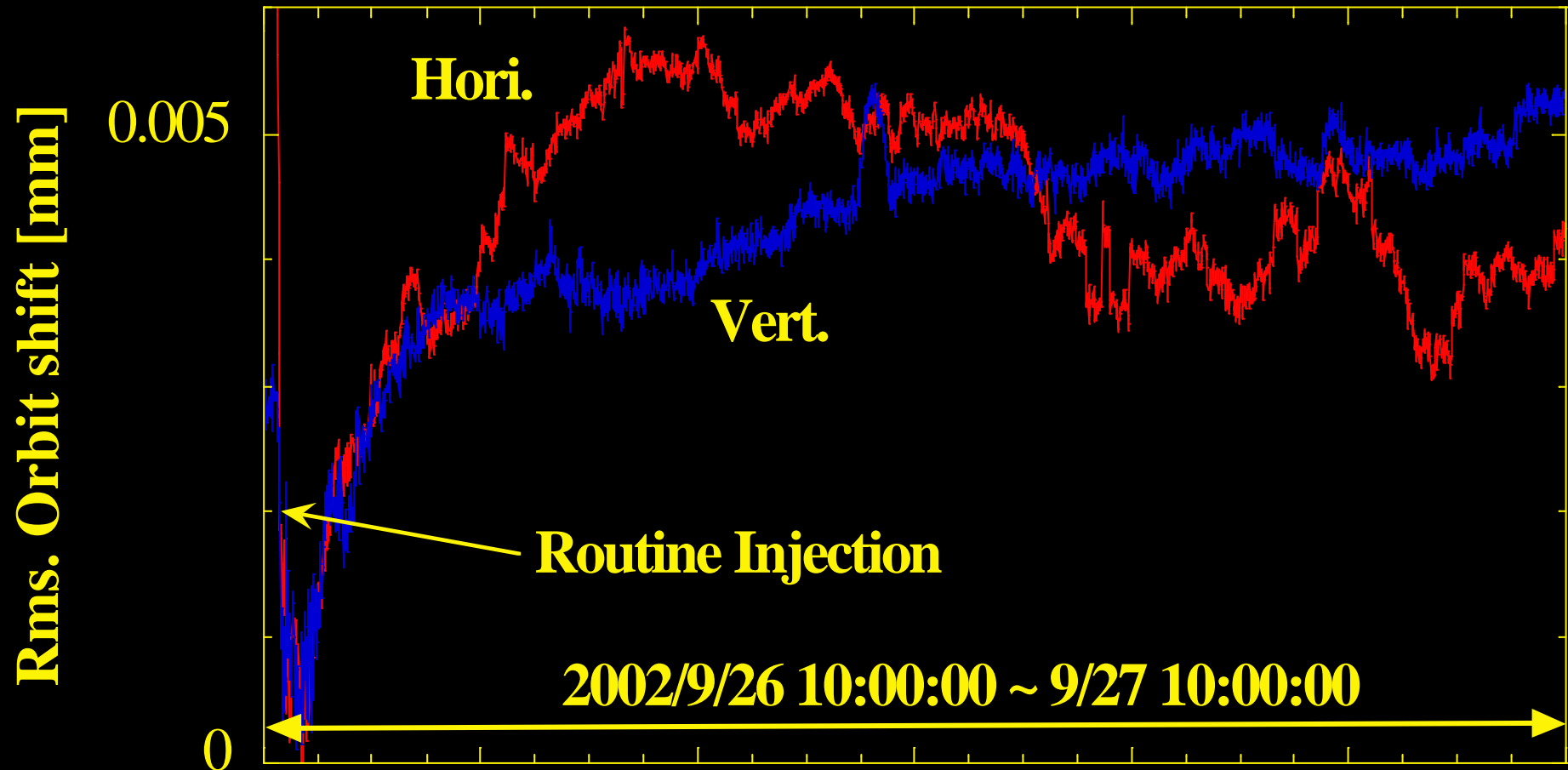
Change of Monochromatized X-ray Intensity



at IWBS2002@SPring-8 2002/12/4~6

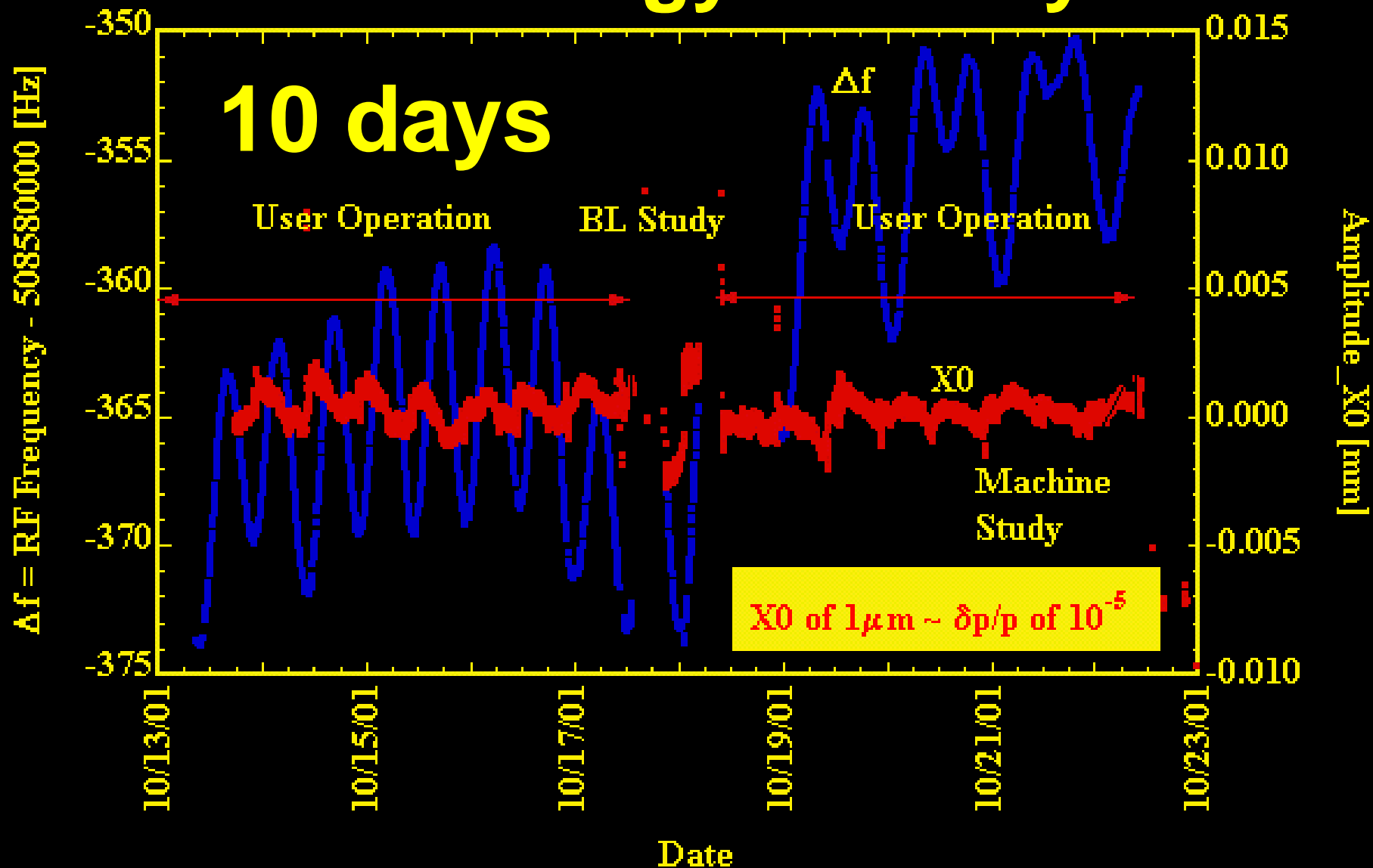


One Day Stability (Slow Component)





Beam Energy Stability





6. Present Orbit Stability

Fast orbit stab. (0.1Hz ~ 200Hz)

Hori. r.m.s. ~4um @ID's H.size=280um

Vert. r.m.s. ~1um @ID's V.size=5~6um

Slow orbit stab. (<0.1Hz)

Hori. r.m.s. 5~6 micron / day

Vert. r.m.s. 5~6 micron / day

Energy drift

~ 2×10^{-5} (full width)

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7. Summary

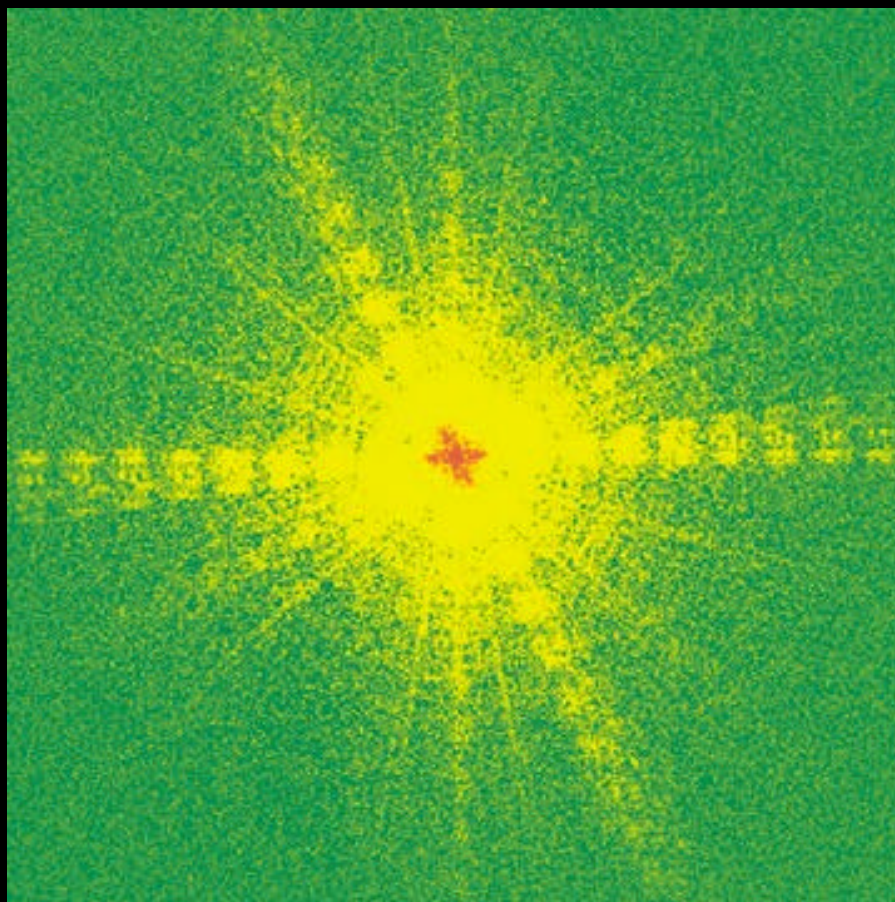
- Systematic source suppression in SPring-8 storage ring successfully realizes good beam stability. Regarding to slow orbit drift there remains some room for improvement. New algorithm is necessary for this cure.
- Systematic source suppression has continued towards sub-micron stability
- Fast and precise BPM system is under development. By using this fast orbit correction will start within a few years.



SPring-8 All Stars



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Jianwei Miao (Stanford) et. al., “High Resolution 3D X-ray Diffraction Microscopy”

These Data were measured at SPring-8 and this fact proves stability and brilliance of SPring-8 X-ray beam

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