



Toward Generation of Vertically Diffraction Limited X-ray Beam

Hitoshi TANAKA
SPring-8, Accel. Div.

Agenda:

- 1. Target*
- 2. Strategy of SPring-8*
- 3. Achieved Results*
- 4. Near Future Plan*

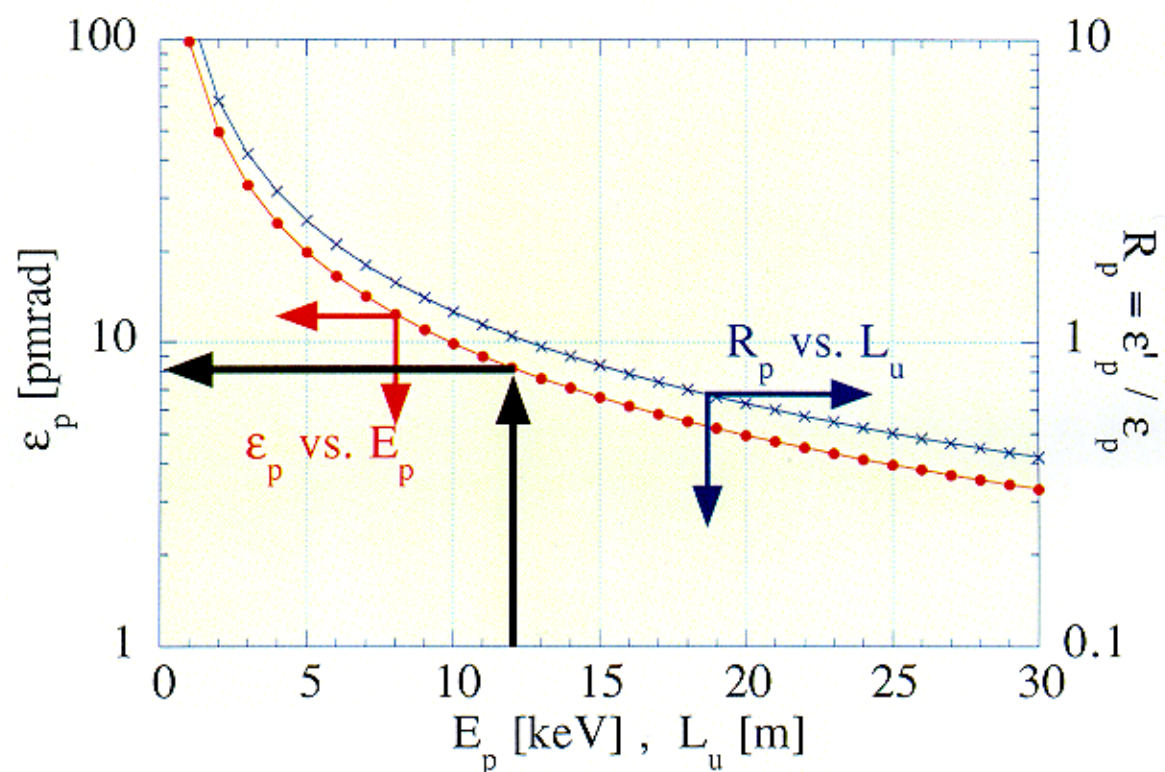
1. Target

Photon Emittance $\mathcal{E}_p$

>> Electron Vertical Emittance $\mathcal{E}_y$

=> $\mathcal{E}_y \sim 1/3 \mathcal{E}_p$ in a Vertical Plane

$\sim 1 \text{ pm} \cdot \text{rad}$ @ $\beta_y = L_u / 4\pi$





2. Strategy of SPring-8

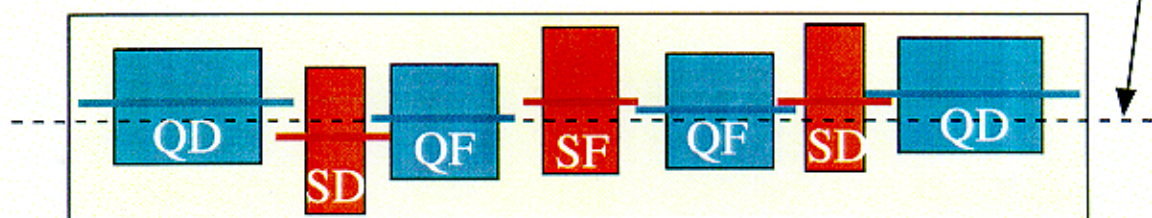
It's simple, "a ring with small coupling sources".

Key Words:

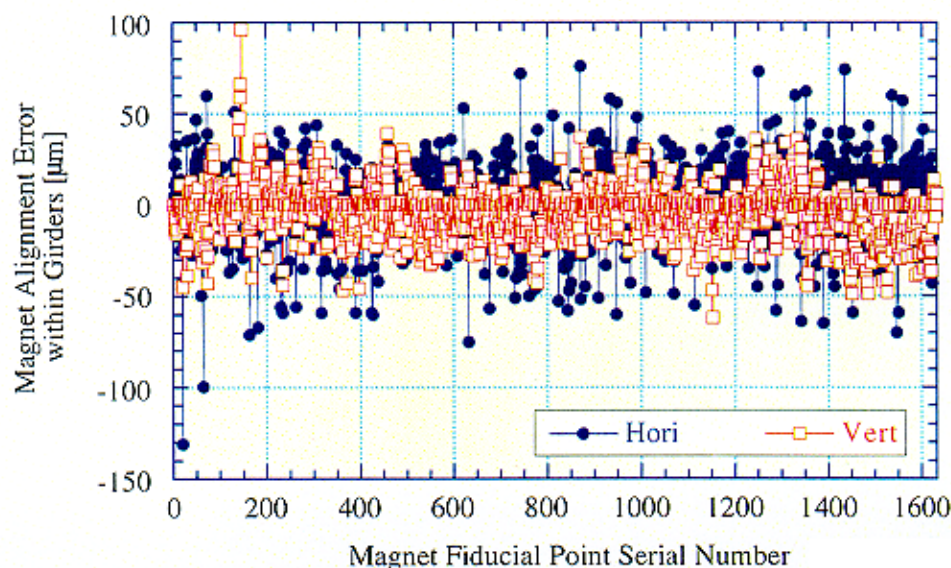
- Reduction of Effective Errors*
- Smooth and Stable Orbit*

• Magnet Girdar System

Center of Nonlinear Lens

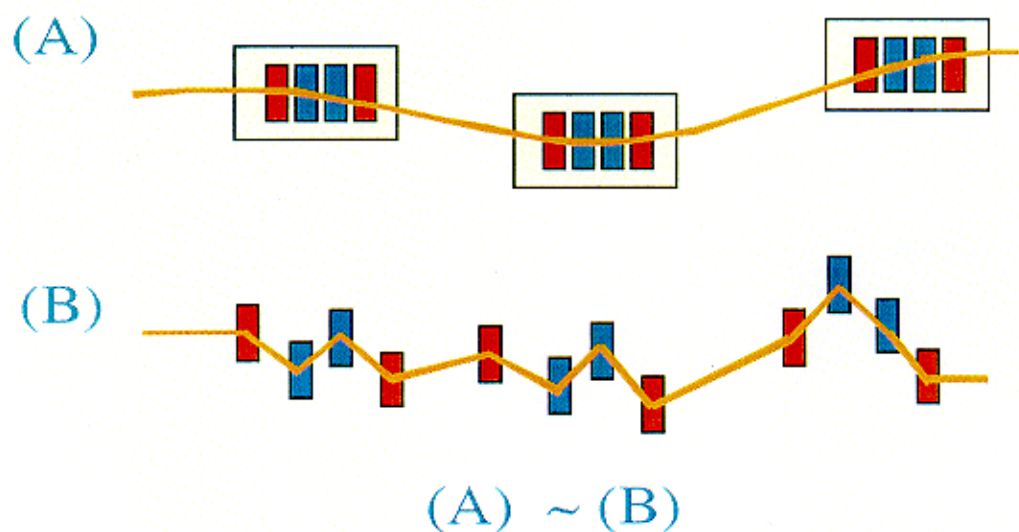


- *R.m.s. misalignment in girders*
 $< 20 \mu\text{m}$ achieved in SPring-8

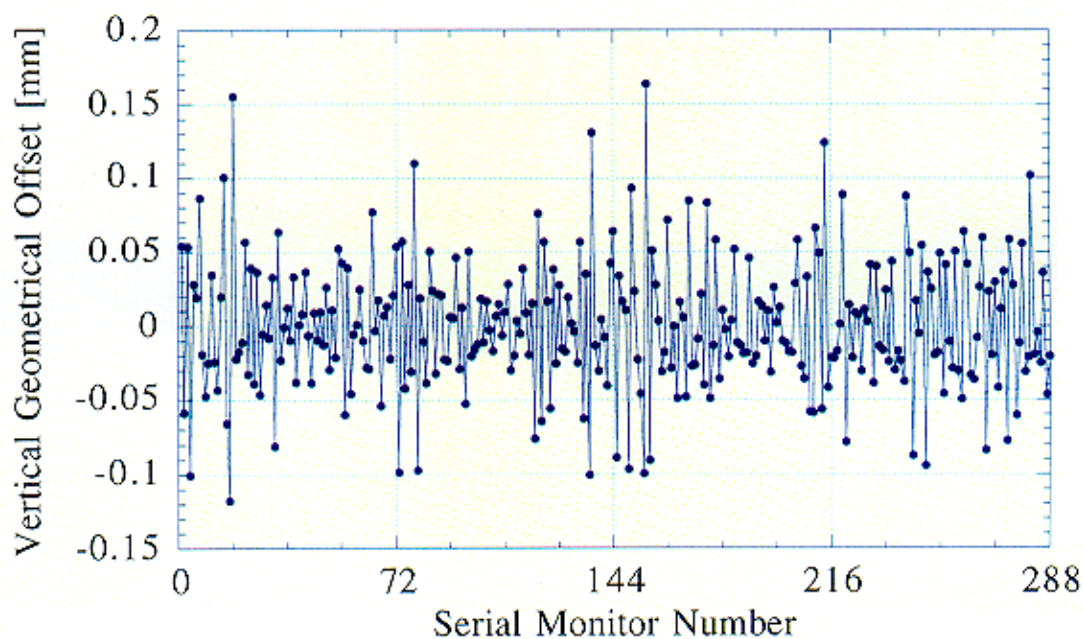


- *Symmetric magnet arrangement*
- *Precise measurement of magnetic center*

• *Smooth and Stable Orbit*

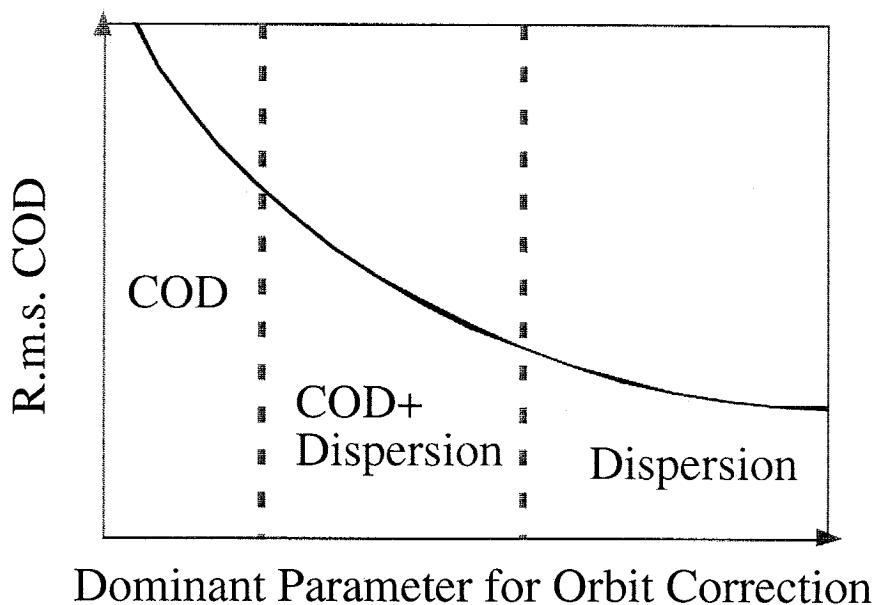


- *Low pass filtering based on magnet alignment data*





•• *Use of dispersion to reach the golden*



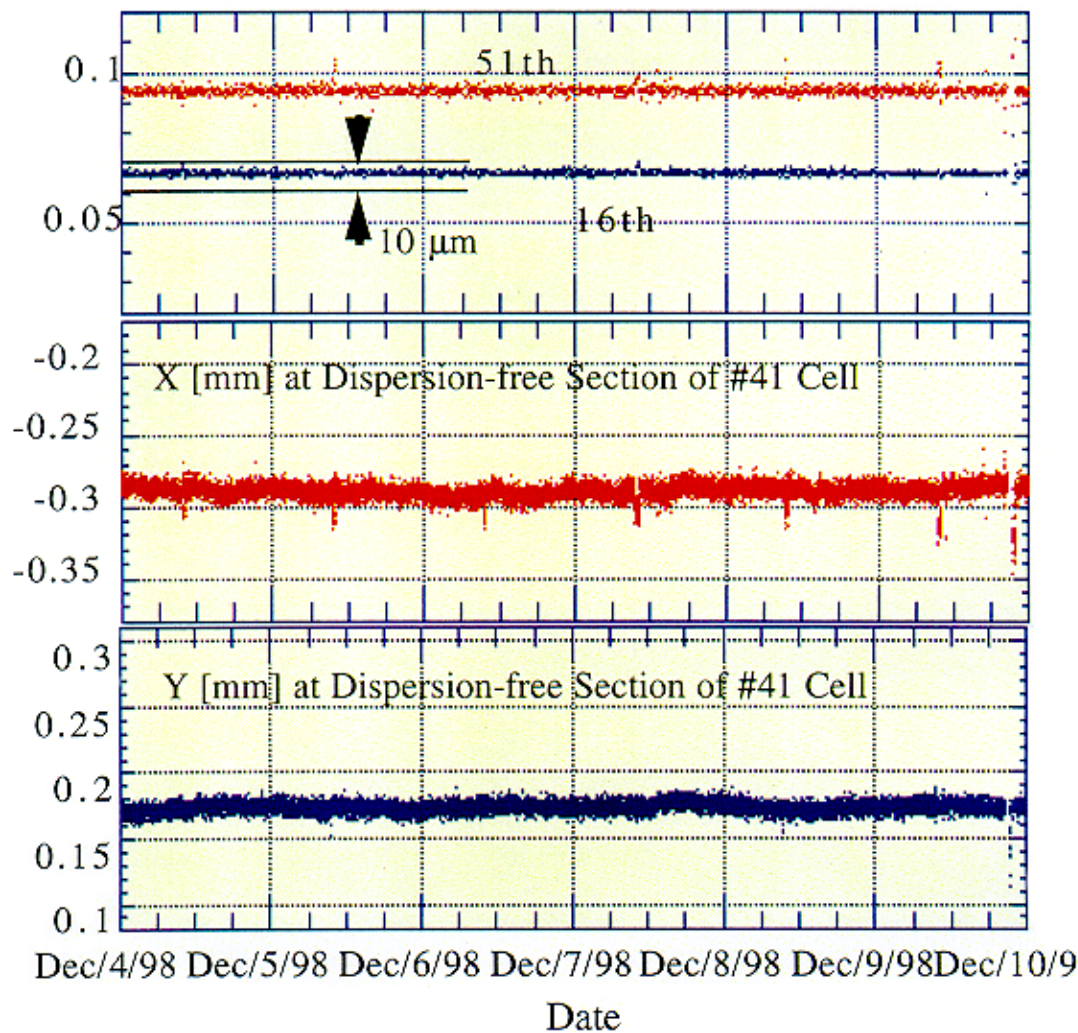
•• *Design consideration for orbit stabilization*

- Construction of a machine tunnel on a hard and stable rock bed.
- Adoption of double compartment structure to make the machine tunnel free from the changes of ambient temperature and sunshine.
- Stabilization of room temperature in a machine tunnel within 1 degree centigrade.
- Stabilization of cooling water within ± 1 degree centigrade.

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- *Design consideration + periodic COD correction*
Achieved stability $\sim 10\mu\text{m}/\text{day}$

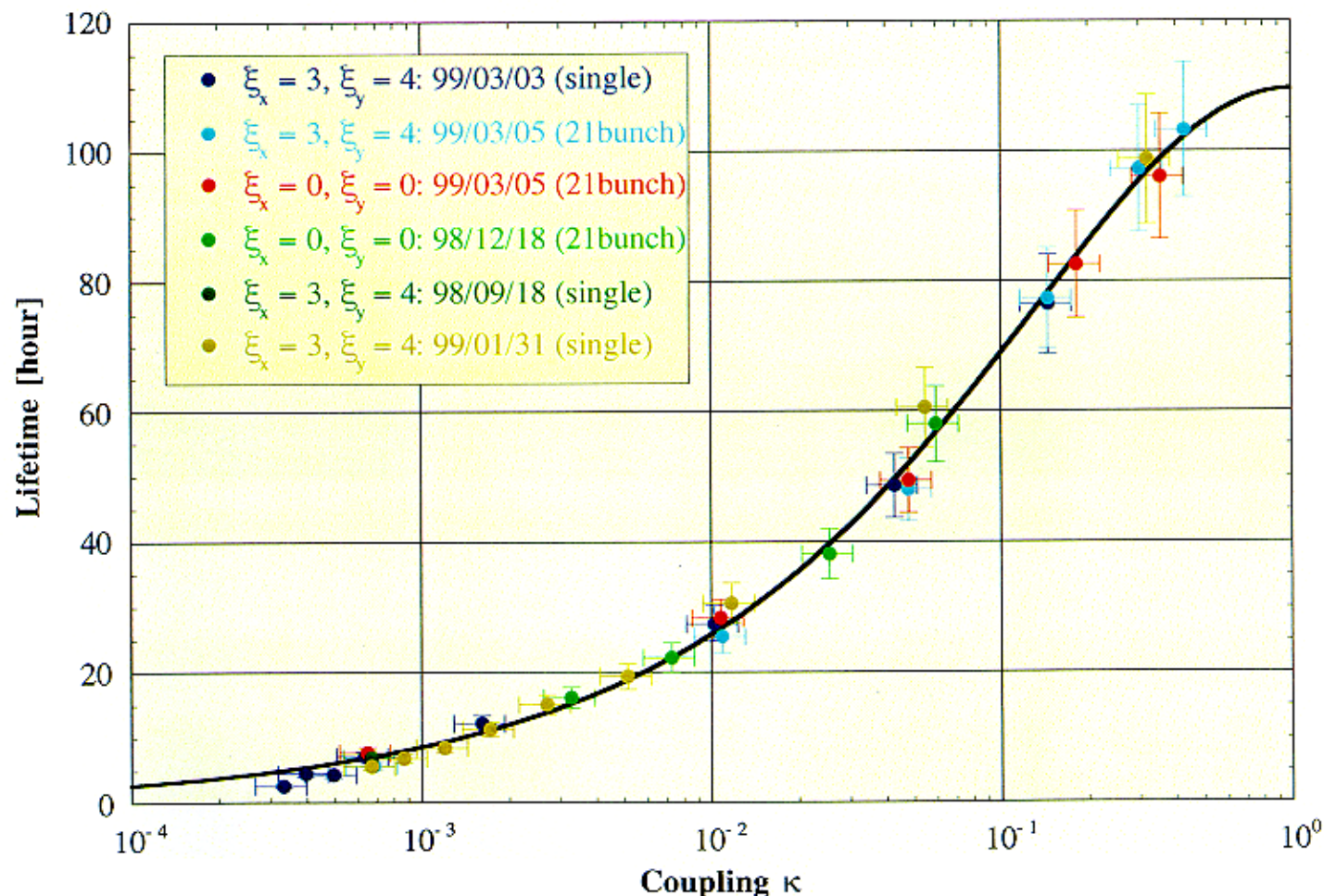


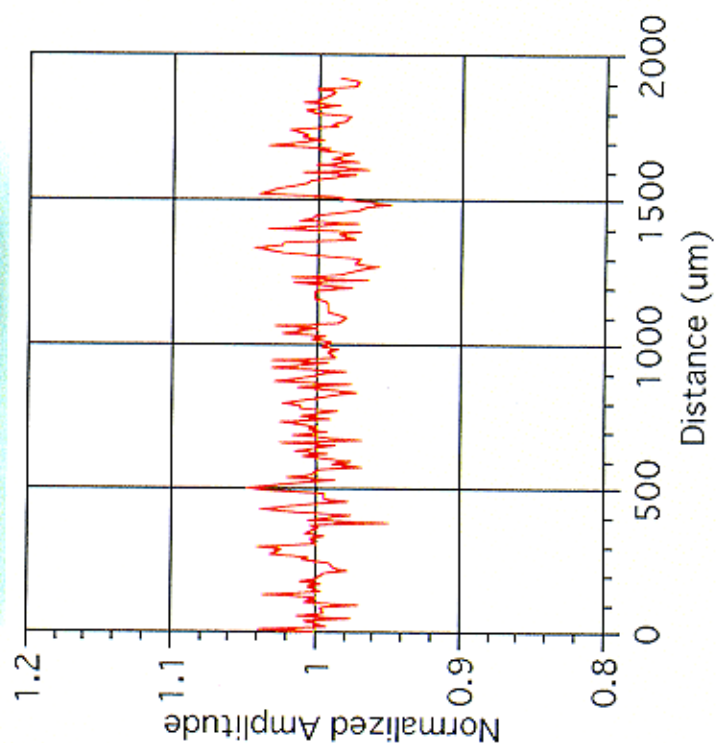
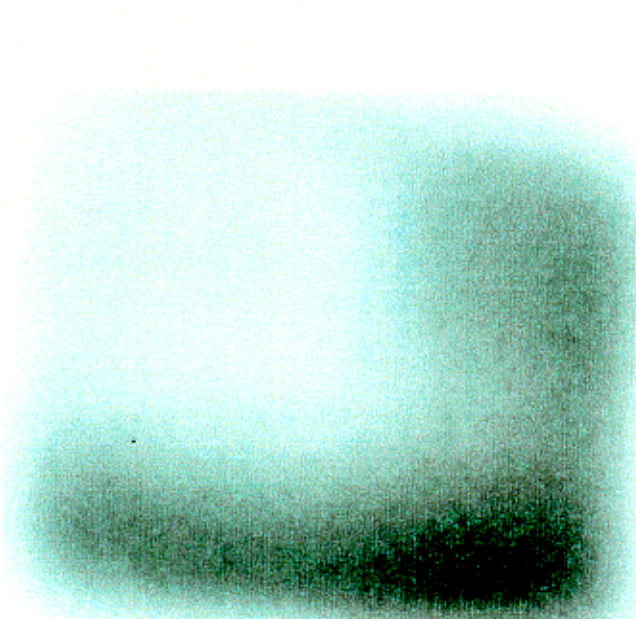


3. Achieved Results

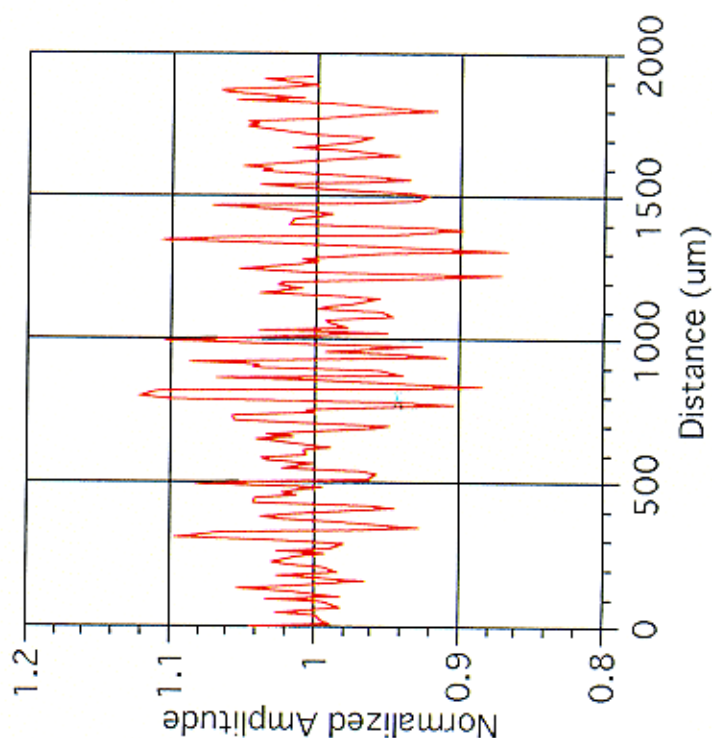
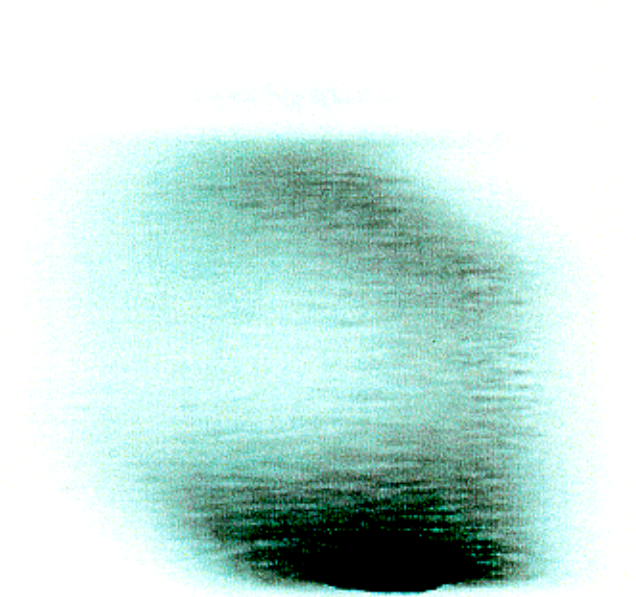
- *Touscheck lifetime basis*
4~7pm•rad (bare ring)
15~25pm•rad (with IDs)
- *Visibility measurement with*
532 nm visible light
<~21pm•rad (bare ring)
- *Speckle pattern of Be window*
<~40pm•rad (with IDs)

Lifetime @ 1 mA / Bunch





Before Improvement (March 1998)



After Improvement (Oct. 1998)

Speckle Pattern of Front-end Beryllium Windows

4. Near Future Plan

- *Emittance or beam size
measurement of $1\text{pm}\cdot\text{rad}$ ($\sim 1\mu\text{m}$)*
- *Vertical dispersion correction*
- *Vertical coupling correction
IDs are strong coupling sources*
- *Orbit stability of $1\mu\text{m}$*

- Vertical dispersion correction with 24 skew quadrupole in dispersive arc*

