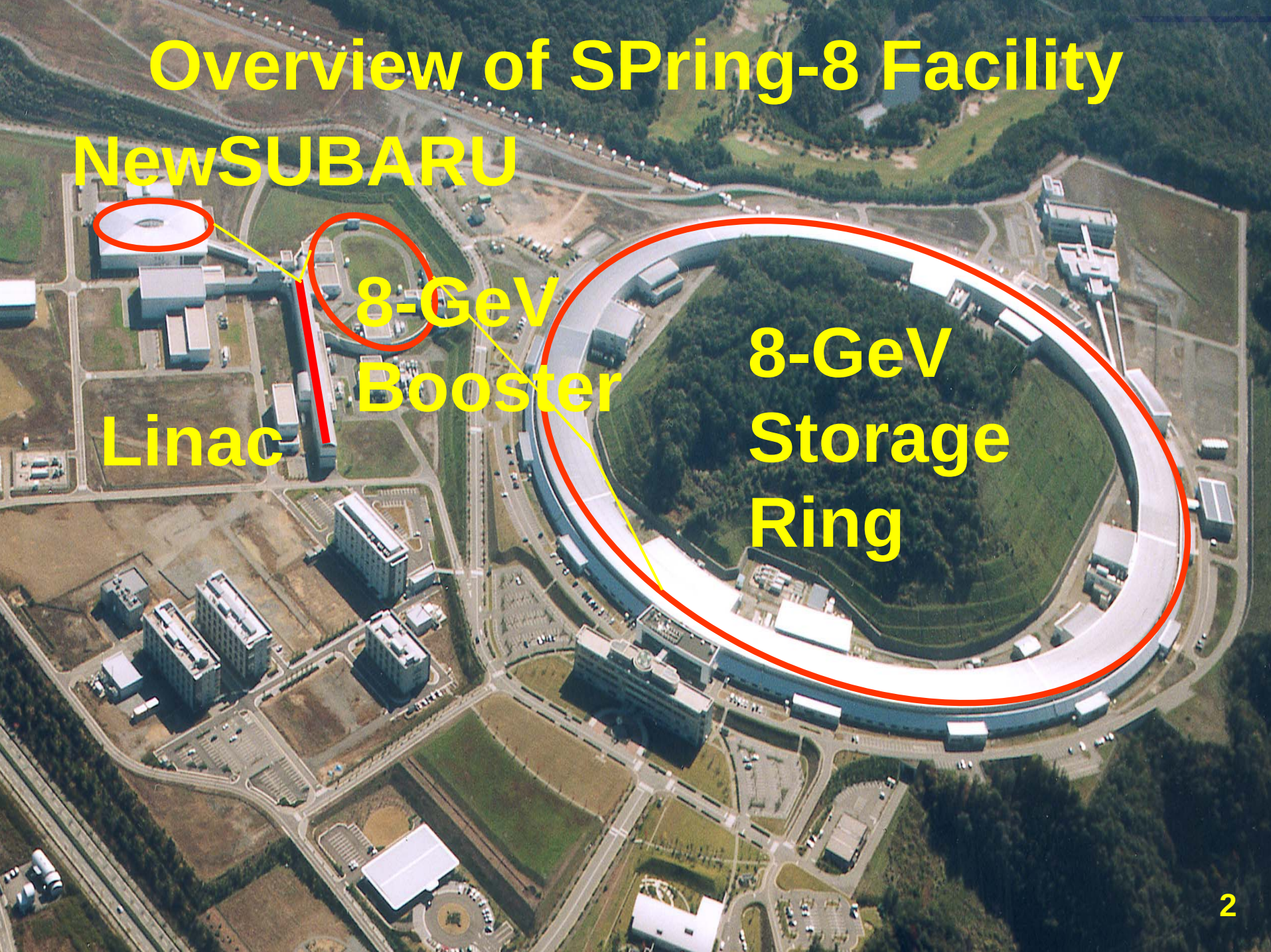
Top-up Operation at SPring-8

Towards Maximizing the Potential of a 3rd Generation Light Source

Presented by Hitoshi TANAKA

on behalf of SPring-8 Top-up Project Team


Overview of SPring-8 Facility
NewSUBARU
8-GeV
Booster
Linac
8-GeV
Storage
Ring

1. Motivation

- Contradiction between high quality beam and long beam lifetime

2. Goal

- Small stored current variation
- Stored beam oscillation-free
- Injection beam loss-free
- Impurity growth-free

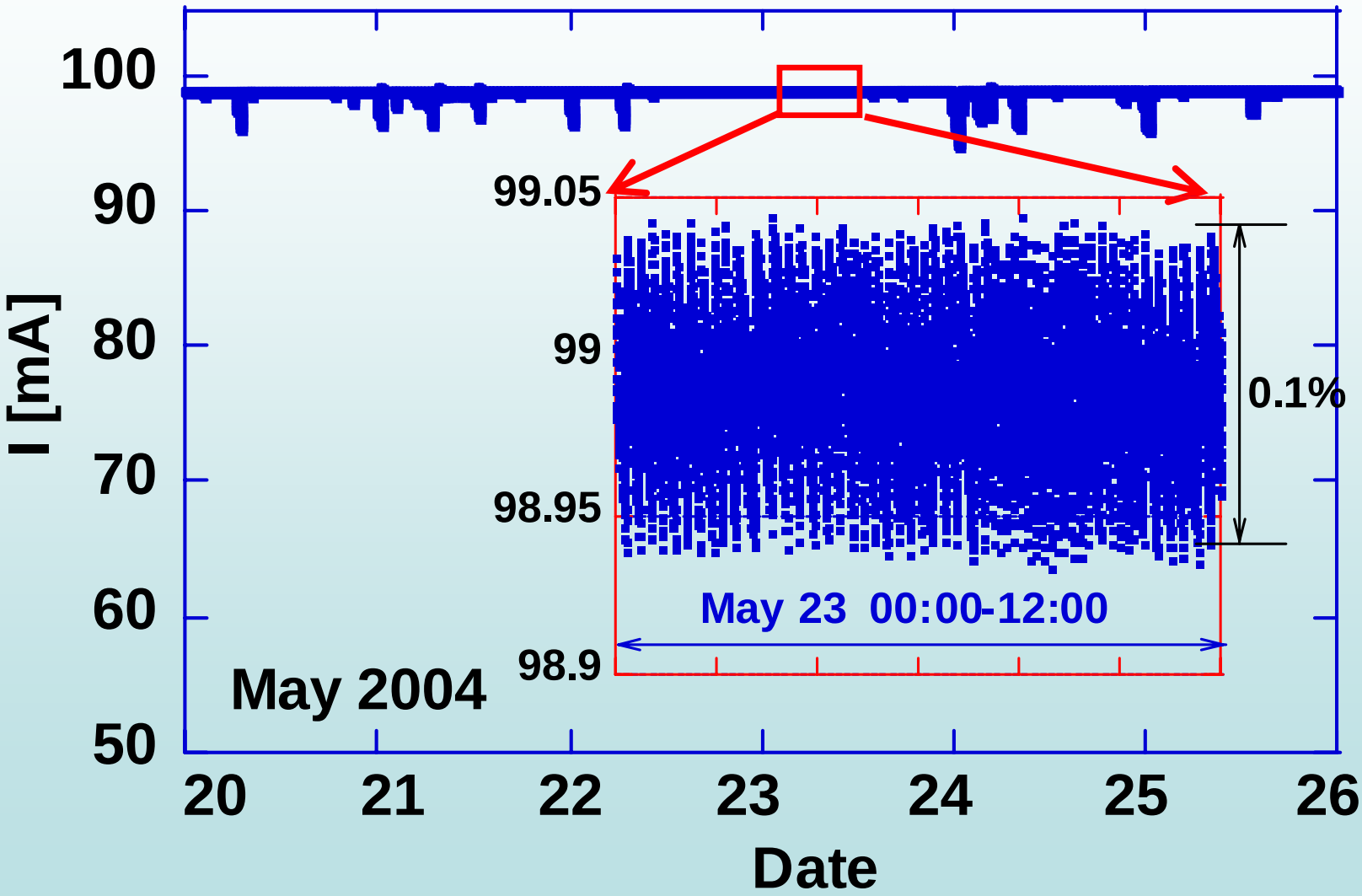
3. Operation status

Top-up has been started since May 20, 2004 achieving;

- **current constancy of 0.1%,**
- **negligible stored beam oscillation,**
- **injection efficiency of 80~90% with IDs closed,**
- **impurity of single bunches ~10^{-9} order**

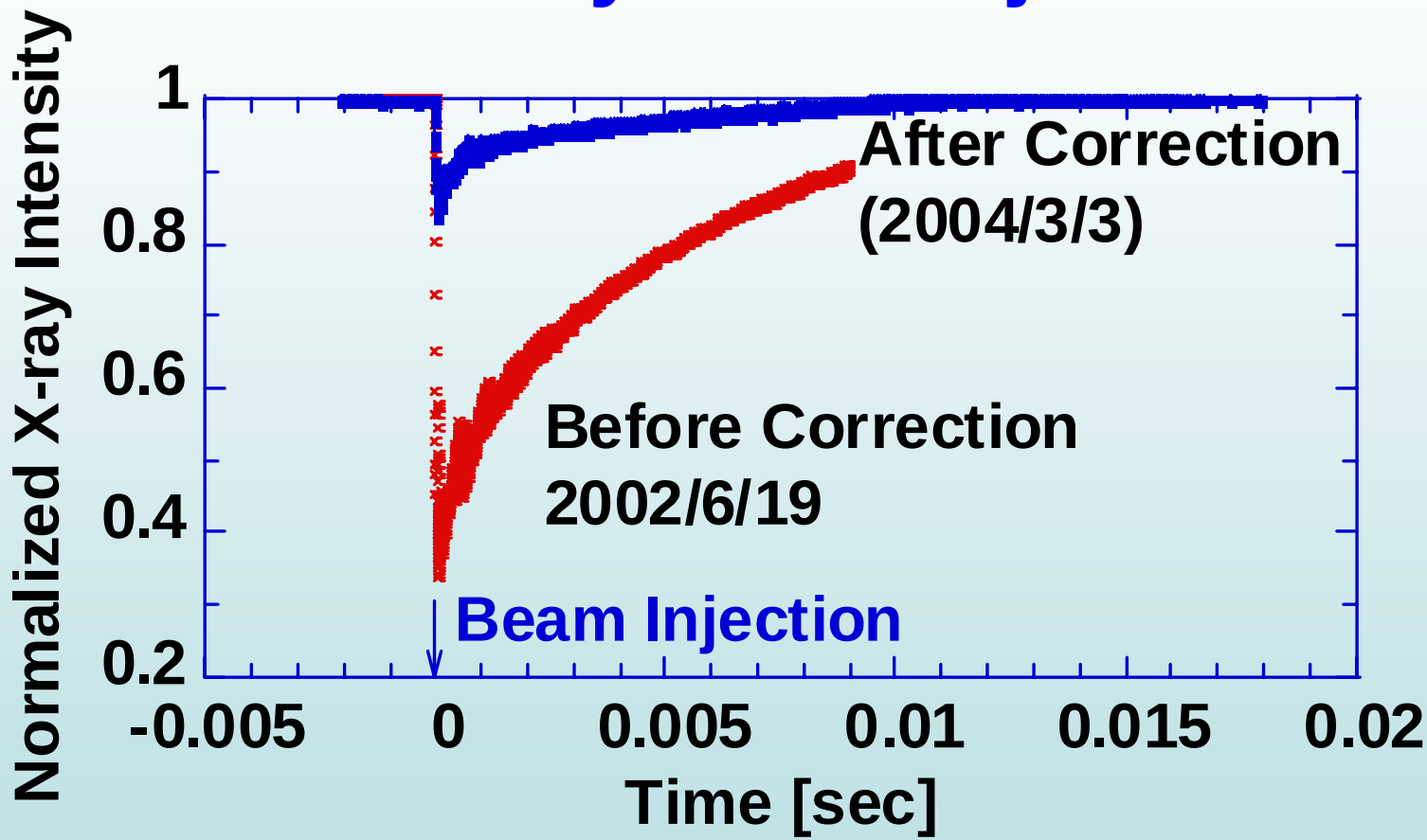
All experiment done without prepared gate signal

3.1. Stored Current Variation



3.2. Stored Beam Oscillation

- Small effect by beam injections



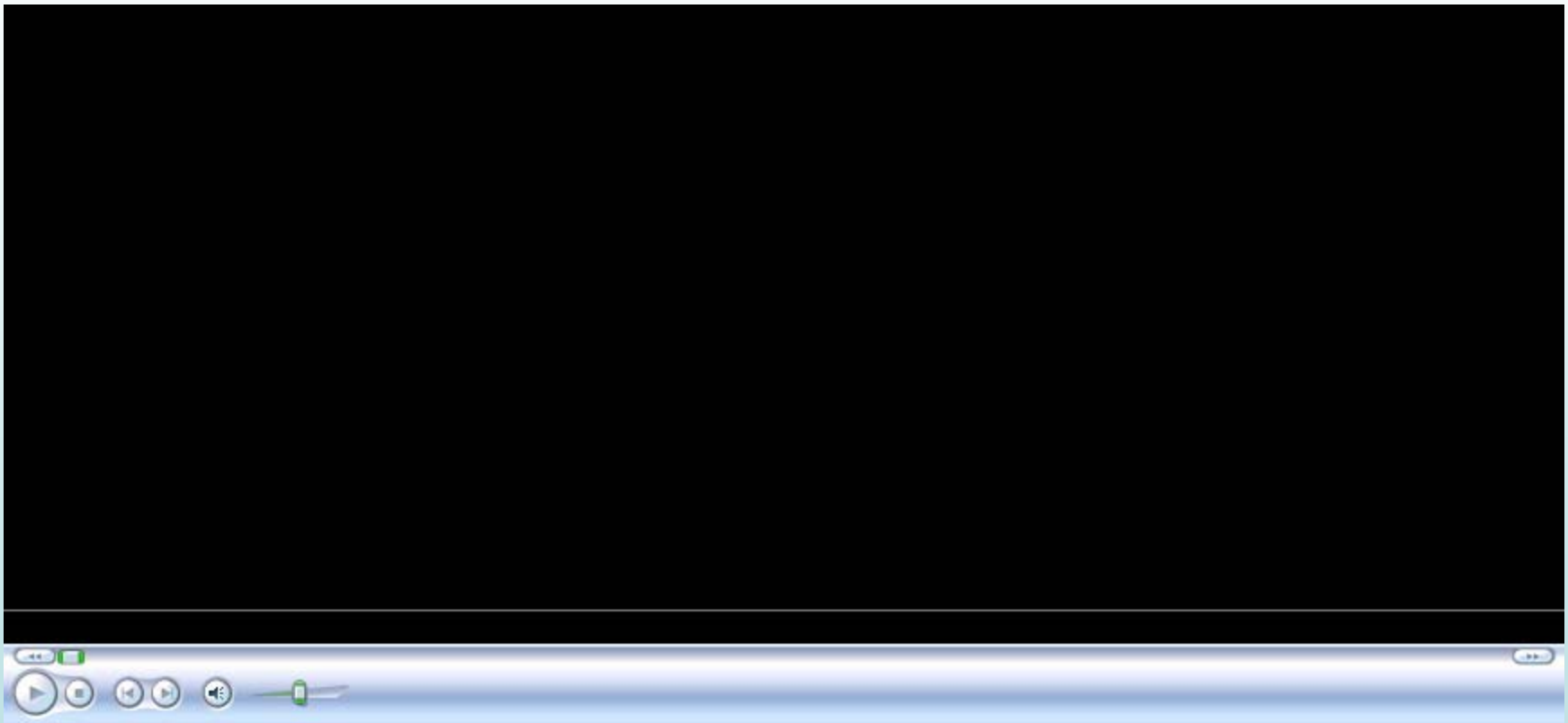
X-ray intensity measured by silicon photodiode in BL39

by courtesy of M.Suzuki (JASRI BL Div.)

3.2. Stored Beam Oscillation (Con't)

In tuning /not initial

Final



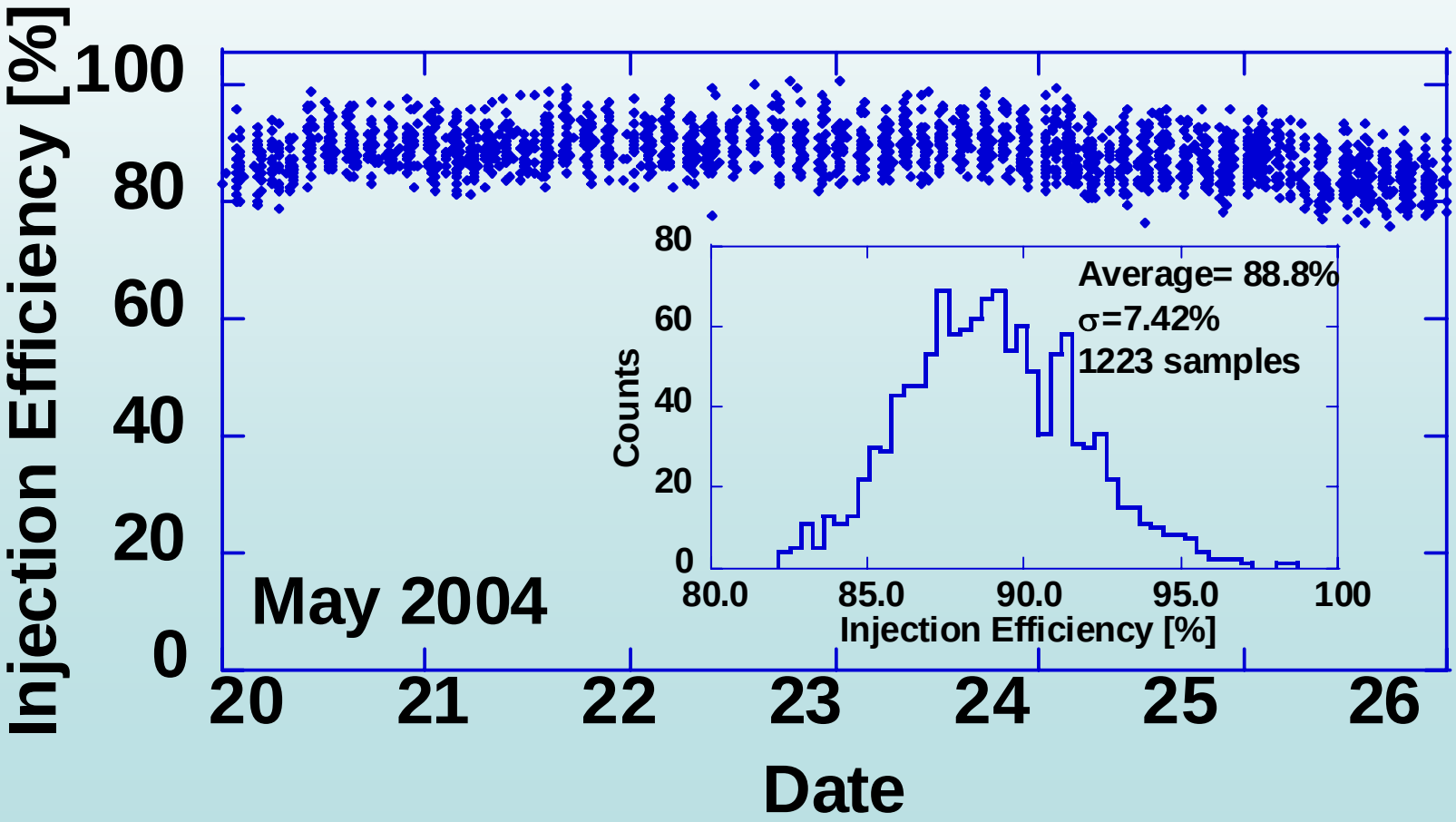
Photon beam image taken by CCD camera in BL20XU

by courtesy of Y.Suzuki and K. Uesugi (JASRI BL Div.)

3.3. Injection Beam Efficiency

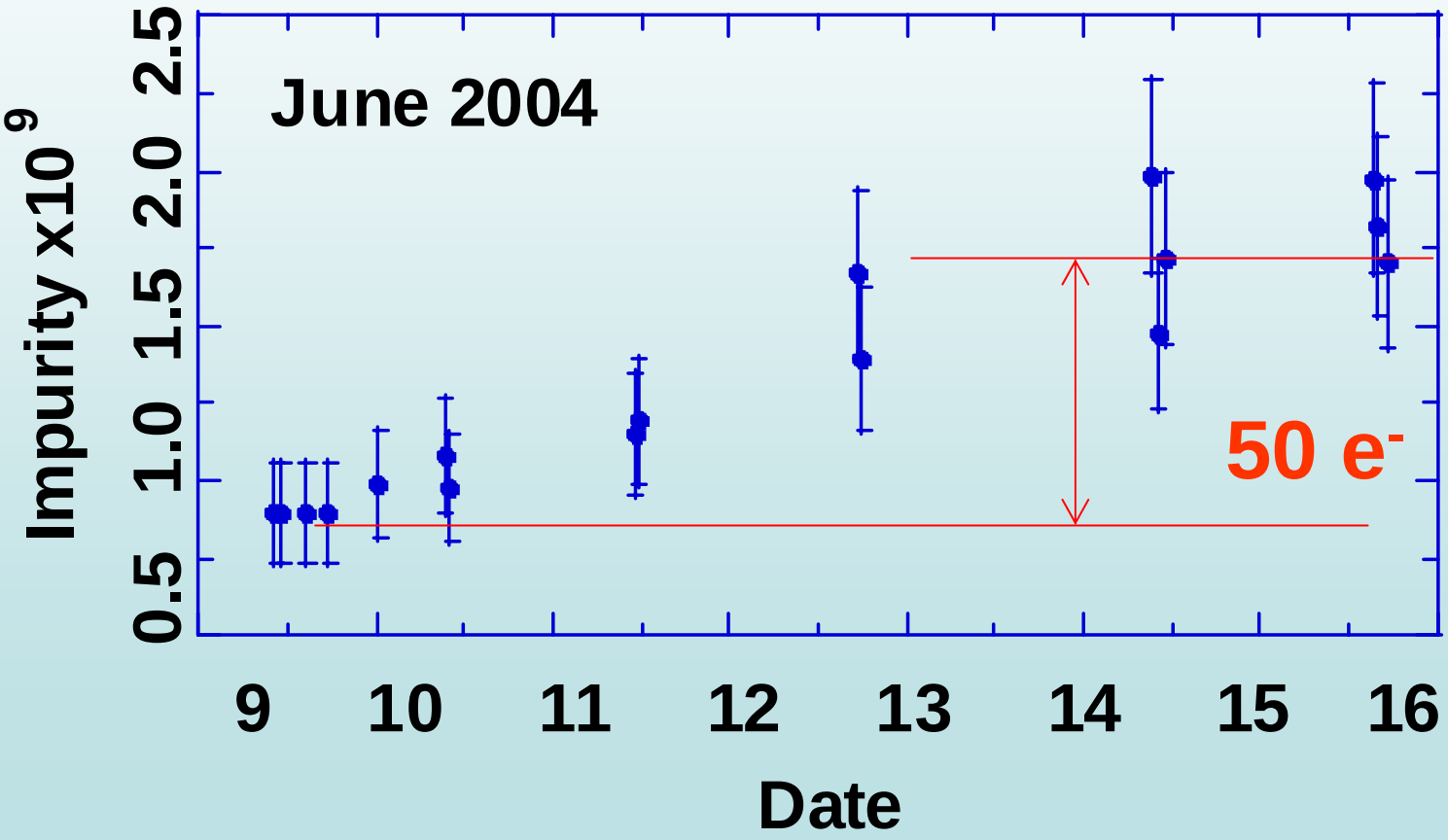
80~90% with gaps of in-vacuum IDs closed

- 20 in-vacuum IDs
- The minimum gap height = 7mm (Full width)



3.4. Impurity of Target Bunches

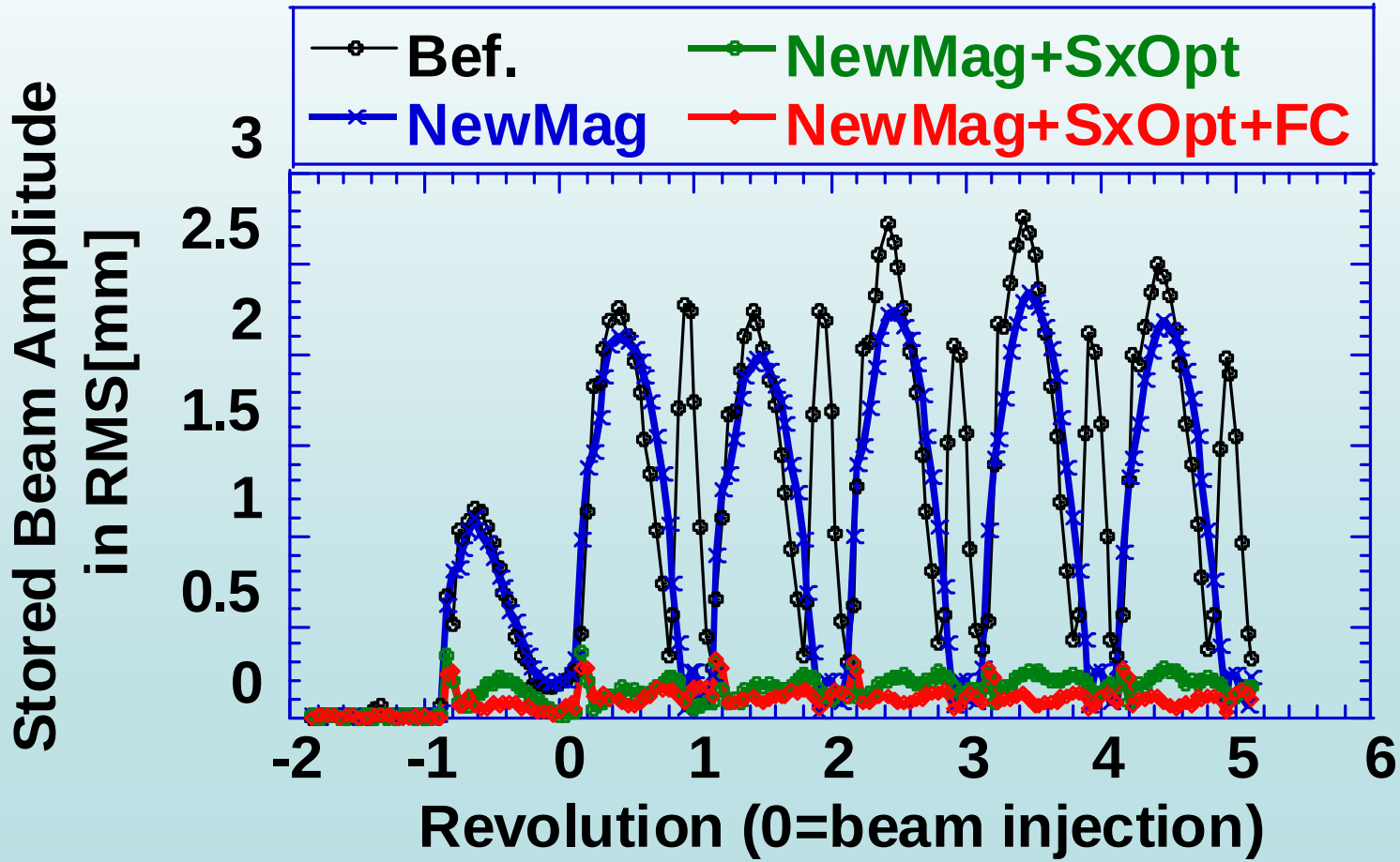
- Impurity of single bunches in the ring is ~10^{-9}
- Impurity of injected single bunches is ~$1x10^{-10}$



4.1. Suppression of Hori. Osci.

- Similarity Improvement
- Nonlinear Optimization
- Feed-forward Correction

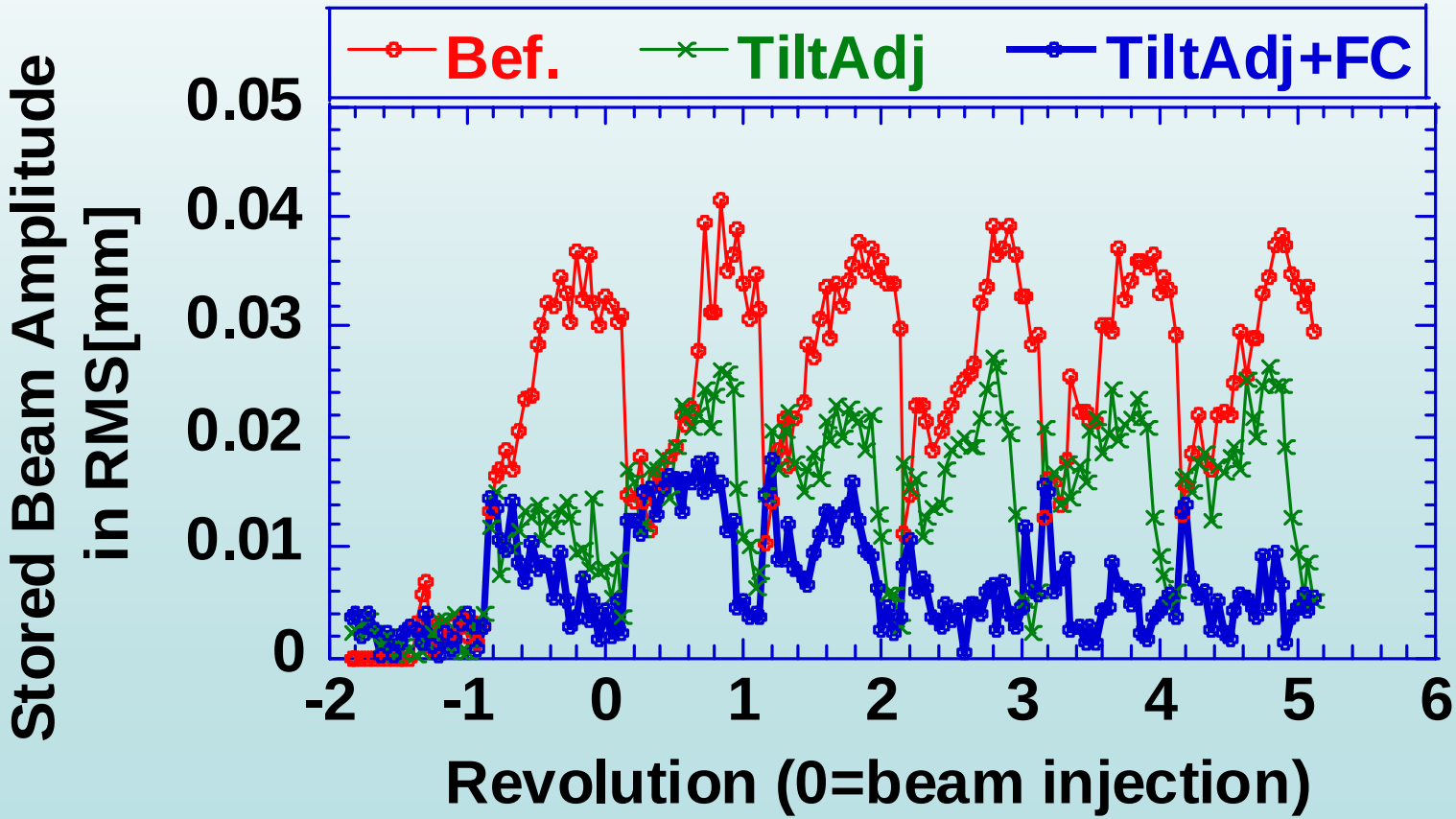
Δx <~1/3 Hori.Beam Size



4.2. Suppression of Vert. Osci.

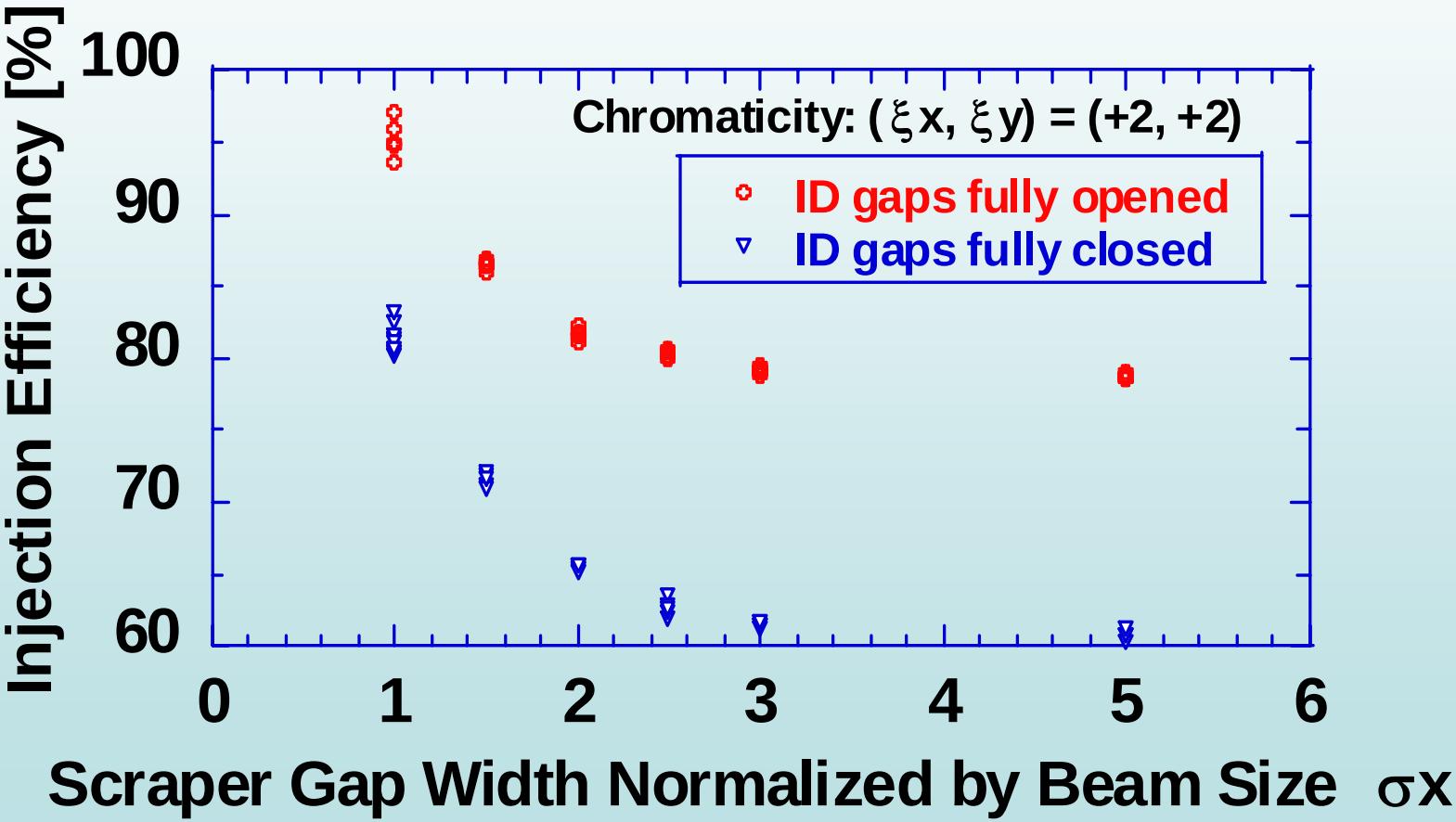
- Tilt Errors Correction
- Feed-forward Correction

Δy <~1/2 Vert. Beam Size



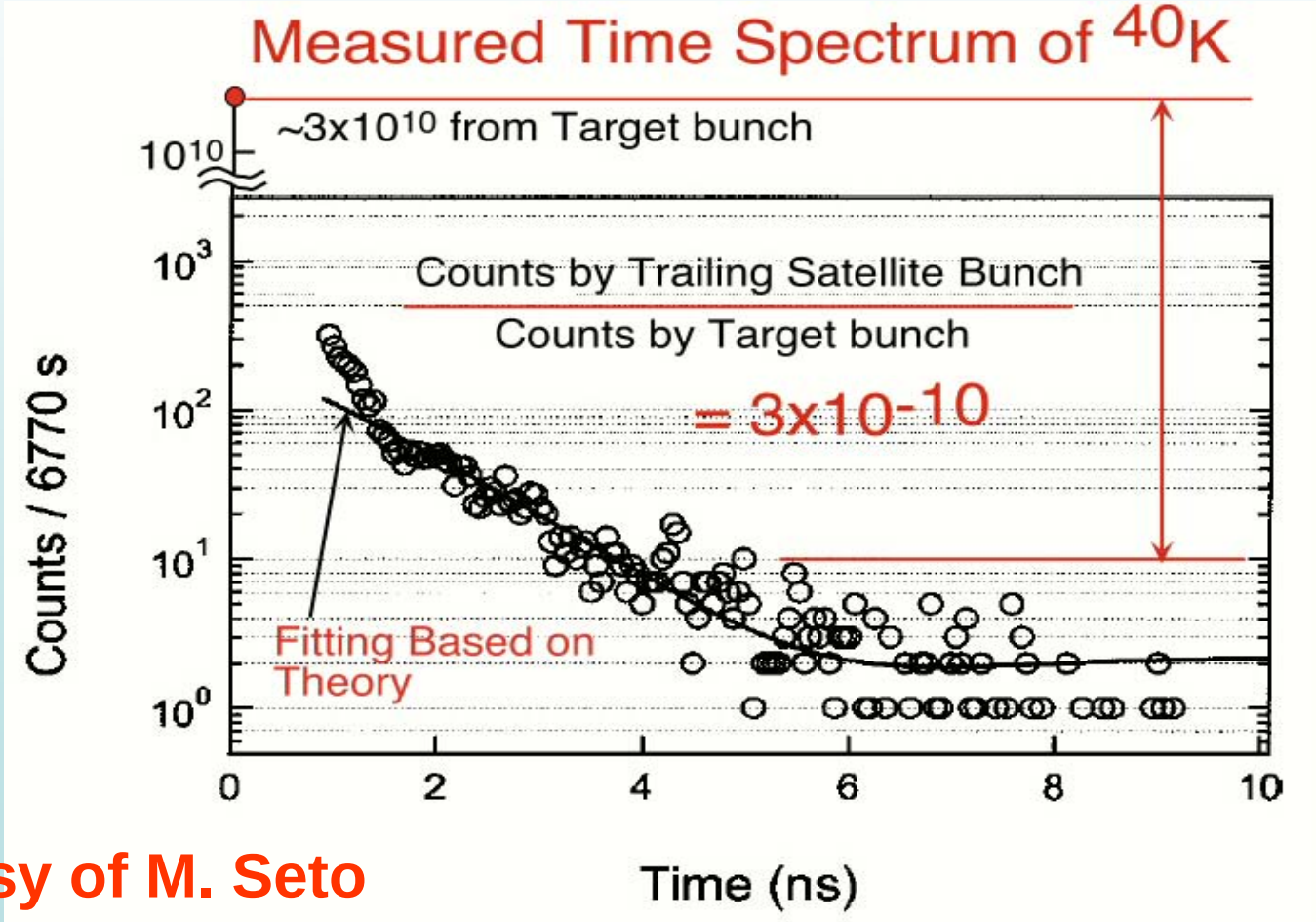
4.3. Beam Loss Reduction

- Beam collimation system
- Low chromaticity operation by BBF



4.4. Reduction of Impurity Growth

- bunch cleaning system in booster
- strong radiation damping in storage ring



by courtesy of M. Seto

5. Conclusion

- Top-up operation of the SPring-8 storage ring has been started achieving the target performance required by the experimental users
- However, we never stop here and continue improving the performance further towards the “ideal top-up”
- This autumn, fast switching of two beam injection paths is scheduled to stabilize the stored current more and this enables simultaneous top-up operation of “two rings”

6. Related Contributions

<Oscillation Free-Beam Injection>

1. MOPKF047 “Suppression of Stored Beam Oscillation Excited by Beam Injection” by T. Ohshima,
2. TUPLT076 “Optimization of Sextupole Strengths in a Storage Ring for Top-up Operation” by H. Tanaka

<Loss Free-Beam Injection>

3. MOPKF048 “Injection Beam Loss at the SPring-8 Storage Ring” by M. Takao
4. THPLT068 “Transverse Bunch-by-bunch Feedback System for the SPring-8 Storage Ring” by T. Nakamura

<Stability of Stored Current>

5. TUPLT075 “Improvements of SPring-8 Linac towards Top-up Operation” by S. Suzuki

<Impurity Growth Free-Beam Injection>

6. TUPLT074 “Dark Current Reduction System for SPring-8 Linac” by T. Kobayashi

Members