PRESENT STATUS OF NEWSUBARU

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Abstract

Present status of the NewSUBARU storage ring is summarized. The machine performance is now in the better level than those of the designed. The efforts for this achievement will be described in another activity reports.

1 INTRODUCTION

NewSUBARU [1] is a 1.5 GeV synchrotron radiation ring at the SPring-8 site. Laboratory of Advanced Science and Technology for Industry (LASTI) at the Himeji Institute of Technology is in charge of its operation, collaborating with SPring-8. The main parameters of the storage ring are listed in Table 1.

The ring has two operation modes for users. In the 1.5 GeV mode, the beam is accelerated to 1.5 GeV and stored. The user time starts at the stored beam current of 300mA as shown in Fig.1. In another mode, 1.0 GeV top-up mode, the beam current is kept at 250±0.15 mA by an occasional injection as shown in Fig.2, with the gaps of undulators closed.

The design goal of the beam current and the beam lifetime were successfully achieved as shown in Table 1. The RMS of the closed orbit distortion (COD) can be adjusted to less than 6 μm in horizontal and 8 μm in vertical at both 1.0 GeV and 1.5 GeV.

Table 1: Main Parameters

Energy	0.5 ~ 1.5 GeV
Circumference	118.731 m
RF frequency	499.956 MHz
Natural emittance	38 nm @ 1 GeV
Filling pattern	Successive80+80 bunches
Maximum current	50 mA/bunch 500 mA /ring @ 1 GeV
Lifetime	14 hours @ 100 mA & 1.5 GeV
Tune ν_x / ν_y	6.30 / 2.23
Chromaticity ξ_x / ξ_y	3.2 / 5.8
Linear coupling constant	1 %
RMS -COD x / y	6 / 8 μm

2 EFFORTS FOR IMPROVEMENT

The beam physics and accelerator physic group paid many efforts day by day to improve the storage ring performance. Figure 3 shows the achieved maximum stored current and corresponding typical efforts. The followings are the main improvements and their results.

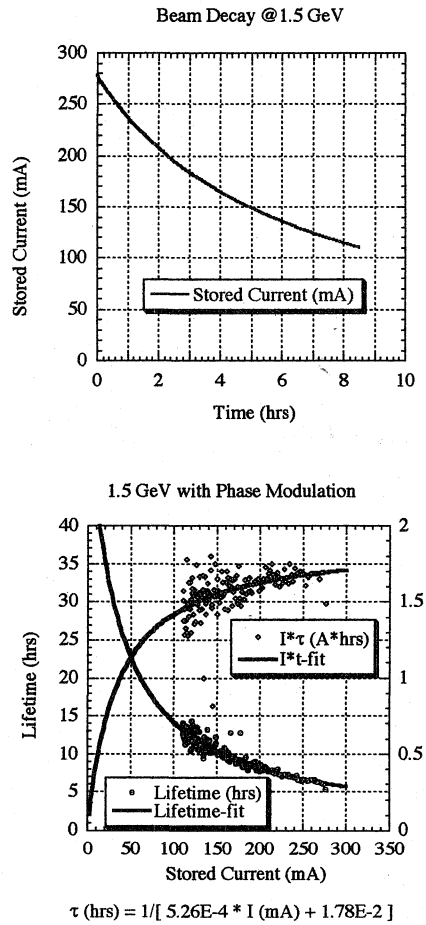

Figure 1: Stored beam current and and lifetime during the 1.5GeV user time.

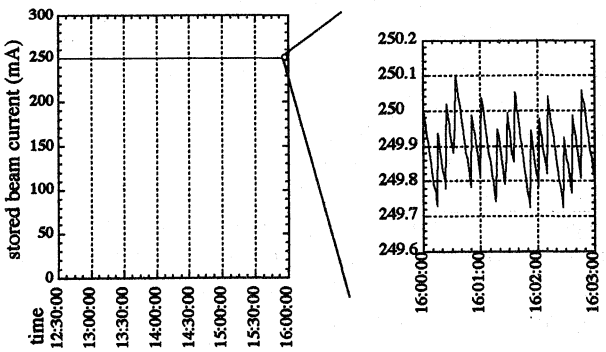

Figure 2: Stored beam current during the top-up operation at 1.0GeV.

The inverter system for the water cooling was installed in summer of 2003 for more stable operation.

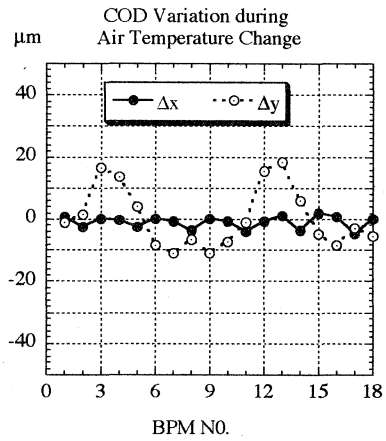

Figure 4: COD shift against room temperature.

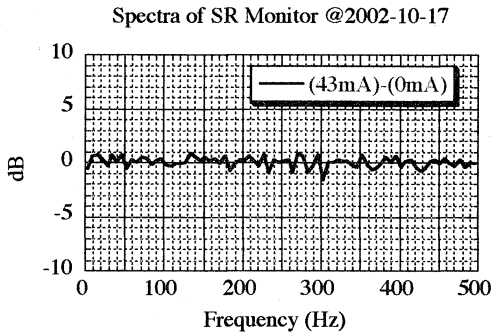

Figure 5: Spectral of SR Monitor.

4.6 Control system

a) Automatic COD correction

The COD are easily realize to keep 6~ 8 μm in rms just by one button operation. This is very useful for the user time to keep the SR axes stable.

b) Simultaneous observation of air and water temperature

The systematic analysis of the drifts in COD and SR axes became possible. The sign of the beam energy drift due to the air temperature change was observed even when there was no COD drift. The more accurate orbit control is going to be implanted.

c) Improvement of the database of the storage ring

The model machine in the database should be the same as the real storage ring. This is the key to realize a very small and/or negative α_p lattice to obtain a very short bunch. The database has been updated mainly by adjusting the effective lengths of magnets comparing measured Twiss parameters with calculated ones.

3 R&D

3.1 Very Short Bunch

Toward generating the coherent radiation in mm wavelength region, the very short bunch operation has been tested by reducing the momentum compaction factor. The preliminary result is shown in Fig.6. The bunch current is very weak and almost 1/10,000 of those of normal operation. Even the number electrons in a bunch is only 3×10^5, The strength of the coherent radiation is corresponds to those of incoherent one from 10^{11} electrons. The obtained rms bunch length is 1.7 psec and this is the world shortest bunch in a storage ring.

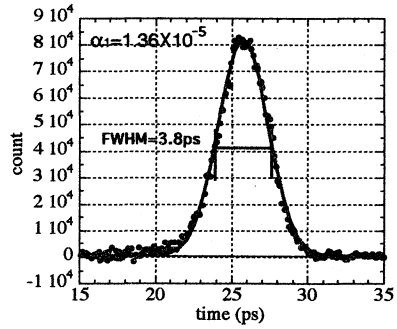

Figure 6: Preliminary result of short bunch.

3.2 Negative α_p

The operation of $\alpha_p = -1 \times 10^{-3}$ has successfully performed with the injection efficiency of ~70 % (without beam centre correction in the beam transform line). The appearance of energy widening, bunch lengthening and head-tail instabilities are completely different from those at positive α_p. The quantitative research is possible only at NewSUBARU in the world and our analysis will contribute the development of beam physics.

4 ACKNOWLEDGEMENT

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6 REFERENCES

[1] A. Ando, et al., J. Synchrotron Rad. 5, 342-344 (19