

Accelerator Division -General-

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In FY 1997, the main task of accelerator division was to complete the beam commissioning of storage ring and to provide the user with an X-ray source of high brilliance and high orbit stability. The basic beam performance of storage ring achieved by the end of March 1998 was listed in Table 1. As can be seen in Table 1, all of these specification have been achieved in this fiscal year as a result of the hard and rewarding effort made by all SPring-8 staff members.

The Accelerator Division will now concentrate on the following tasks:

- to operate the electron beam reliably at the best performance in order to support the experimental program.
- to further improve the beam quality, such as emittance, coupling, stable orbit, etc.
- to increase the beam current of storage ring to 100mA, which is a target value in the second phase.
- to further use the SPring-8 accelerator resources and its associated instruments.

Table 1 Machine performance of storage ring achieved by the end of March 1998

	Specification in first phase	Performance achieved
Energy of the stored beam	8GeV	8GeV
Stored beam current		
in multibunch mode	20mA	approx.20mA
in single bunch mode	5mA	approx.5mA
Life time		
in multibunch mode of 20mA	50hours	100hours
in single bunch mode 1mA	—	10hours
Horizontal emittance ($V_x=51.22$, $V_y=16.30$)	7nmrad	7.3 ± 0.5 nmrad \pm
Coupling	10%	0.15%
Orbit stability		
in horizontal direction	—	$\pm 15 \mu\text{m}/(\text{one week})$
in vertical direction	—	$\pm 20 \mu\text{m}/(\text{one week})$

-Linac-

In 1997, the improvement of beam quality

was carried out and the linac was steadily operated for providing a stable electron beam with 40nsec or 1 μ sec pulse length and 10-100mA beam current into the 8GeV booster synchrotron. Also, the new transport beamline, which provides the 1GeV electron beam from the linac to a NEW-SUBARU(1.5GeV storage ring) and an experimental hall, are under construction. The beam commissioning will be started at September 1998.

-Booster Synchrotron-

To realize the single bunch operation in the storage ring, a rf-knockout system was installed in the synchrotron. After the fine tuning, the single bunch beam was injected to the storage ring from November 1997. The beam impurity of less than 10^{-6} was confirmed by a single photon counting method at a photon beam line(BL09) in the storage ring.

-Storage Ring-

The storage ring was commissioned from the middle of last March and the target beam current of 20mA in the first phase was achieved at April 17, 1997 with the life time of 3 hours. Then a continuous self-cleaning by the synchrotron radiation was carried out to improve the beam lifetime and by the end of 1997, the beam life time of approximately 100 hours at the multibunch mode of 20mA was achieved for an accumulated beam dose of 29Ahours. This life time is determined by the scattering between electron and residual gases in the vacuum chamber. On the other hand, the beam life time in the single bunch mode is about 10 hours at 1mA/bunch, whose life time is being determined by the Touschek effect. When improving the present coupling coefficient of 0.15% (without skew correction) in the SPring-8 storage ring, the further reduction of the beam life time by the Touschek effect becomes a serious problem for the use of photon beam. Therefore, the overcoming of Touschek limitations is under investigation. Also, the stability of electron orbit was $\pm 15 \mu\text{m}/(\text{one week})$ for a horizontal direction and $\pm 20 \mu\text{m}/(\text{one week})$ for a vertical direction, whose changes were made by the temperature variation of magnet cooling water, the gap change of insertion devices and so on. On the other hand, the energy variation($\Delta p/p$) of the stored beam was about

0.0001/(one day) as contribution from earth tide and less than 0.00001 from the ripple voltage of klystron power supplies. These values are very small against the natural beam momentum spread of 0.001. As a upgrade of beam quality, the stabilization of these beam performance by feed back system is under investigation.

From October 8 ,1997 to the end of March 1998, the beam delivery to the users was carried out without serious machine troubles.