

II. Machine Operation

The operation statistics for the last five fiscal years are shown in Fig. 1. In FY2010, the total operation time of the accelerator complex was 5125.6 hours. The operation time of the storage ring was 5096.3 hours, of which 79.9% (4071.5 hours) was used for SR experiments. The downtime resulting from failure accounted for 0.67% (27.5 hours) of the total user time. In FY2010, no great loss of user time exceeding several hours occurred. In 2004, top-up injection was introduced. Concerning user service operation, a high availability (ratio of net user time to planned user time), i.e., 99.2%, was achieved in FY2010. A total tuning and study time of 1026.6 hours was used for machine tuning, for the study of the linac, booster synchrotron and storage ring, and also for the beamline tuning and study.

Operations in three different filling modes were provided for the following user times: 5.9% in the multi-bunch mode, 56.7% in the several bunch mode, such as the 203-bunch mode (203 equally spaced bunches), and 37.4% in the hybrid filling mode, such as the 1/14-partially filled multi-bunch mode with 12-isolated bunches. In FY2010, the several bunch mode was the dominant filling mode. In particular, the 203-bunch mode reached 30.9% of the total user time. For the hybrid filling mode, 1.0 mA, 1.4 mA, 1.6 mA, or 3.0 mA is stored in each isolated bunch. An isolated

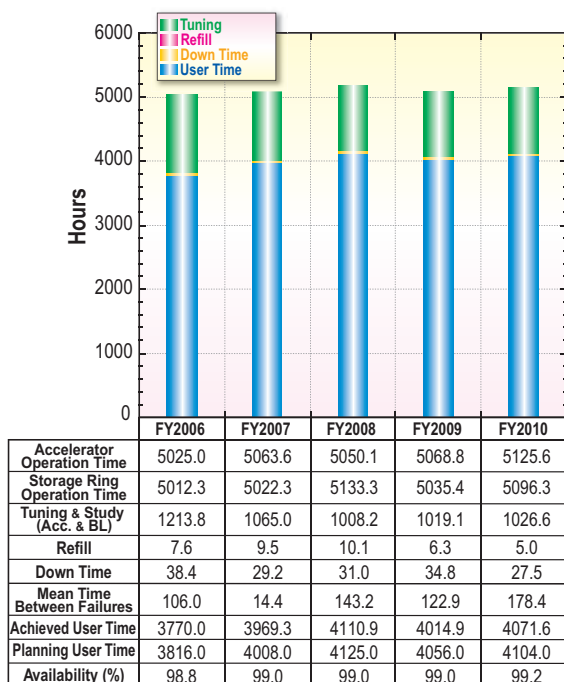


Fig. 1. Operation statistics for last five fiscal years.

bunch impurity better than 10^{-10} is routinely maintained in the top-up operation. Table I shows a summary of the useful beam parameters of the storage ring. Table II shows a summary of the beam filling patterns.

Table I. Beam parameters of SPRING-8 storage ring

Energy [GeV]	8
Number of buckets	2436
Tunes (ν_x / ν_y)	40.135 / 18.345
Current [mA]:	
single bunch	12
multi bunch	100
Bunch length (σ) [psec]	13
Horizontal emittance [nm-rad]	3.4 *
Vertical emittance [pm-rad]	6.8 *
Coupling [%]	0.2
RF Voltage [MV]	16
Momentum acceptance [%]	± 3 (± 240 MeV)
Beam size [μm]: (σ_x / σ_y)* [μm]	
Long ID section	294 / 10
ID section	301 / 6
BM section	107 / 13
Beam divergence [μrad]: (ξ_x' / ξ_y')* [μrad]	
Long ID section	13 / 0.7
ID section	12 / 1.1
BM section	56 / 0.6
Operational chromaticities (ξ_x / ξ_y)	+2 / +6 **
Lifetime [h]:	
100 mA (multi-bunch)	~ 200
1 mA (single bunch)	~ 20
Horizontal dispersion [m]:	
Long ID section	0.103
ID section	0.107
BM section	0.032
Fast orbit stability (0.1 – 200 Hz) [μm]:	
horizontal (rms)	~ 4
vertical (rms)	~ 1

* Assuming 0.2% coupling for "Low Emittance Optics"
** With bunch-by-bunch feedback

Table II. Filling patterns

	bunch current (mA)	life time (h)
Multi-bunch (160 bunch-train \times 12)	0.05	~ 200
203 bunches	0.5	25 ~ 30
11 bunch-train \times 29	0.3	35 ~ 50
1/7 - filling + 5 single bunches	3.0 (single)	18 ~ 25
1/14 - filling + 12 single bunches	1.6 (single)	18 ~ 25
2/29 - filling + 26 single bunches	1.4 (single)	18 ~ 25