

## *Chapter 3 Storage Ring Operation*

The SPring-8 synchrotron radiation facility, which consists of linac, synchrotron and 8GeV storage ring accelerators, has become mature and provides world's most stable X-ray beams to users. This is largely due to the successful top-up operation, injecting electrons as the storage ring loses its current by 30  $\mu$ A. Since the storage ring has a current of 100 mA, it has achieved a current stability of  $3 \times 10^{-3}$ . Under the top-up operation, SPring-8 provides the following bunch-filling options to users in order to meet users' needs:

- A-mode: 203 bunches
- B-mode: 4-bunch train x 84
- C-mode: 11-bunch train x 29
- D-mode: 1/14-filling + 12 bunches
- E-mode: 4/58-filling + 53 bunches

Table 3-1 and Fig. 3-1 show the statistics of the storage ring operation from 1997B to 2007B. In FY2007 (2007A and 2007B), the storage ring ran for approximately 6,000 h and delivered X-ray beams to experimental stations for approximately 4,600 h. Downtimes were 2.5 % of the total user time in average from 1997B to 2007B, and 0.7 % for 2007A and 2007B.

Table 3-1 SPring-8 storage ring operations (1997B-2007B)

Research Term	Period	Storage Ring Operation Time (hours)	User Time (hours)	Downtime for failure (Rate) (hours (%))	Machine Study, Beamline Study & Beamline Tuning (hours)
1997B	Oct. 1997-Mar. 1998	1,932.0	1,286.0	32.0 (2.4)	614.0
1998A	Apr. 1998-Oct. 1998	2,674.0	1,700.5	73.5 (4.1)	900.0
1999A	Nov. 1998-Jun. 1999	3,555.3	2,584.5	71.6 (2.7)	899.2
1999B	Sep. 1999-Dec. 1999	2,117.2	1,371.1	21.2 (1.5)	724.9
2000A	Jan. 2000-Jun. 2000	2,756.5	2,051.0	55.0 (2.6)	650.5
2000B	Oct. 2000-Jan. 2001	2,645.2	1,522.4	35.7 (2.3)	1,087.1
2001A	Feb. 2001-Jun. 2001	2,696.4	2,313.0	68.2 (2.9) <sup>(i)</sup>	315.2
2001B	Sep. 2001-Feb. 2002	2,788.7	1,867.1	26.1 (1.4)	895.5
2002A	Feb. 2002-Jul. 2002	2,795.2	2,093.4	161.3 (7.2) <sup>(ii)</sup>	540.5
2002B	Sep. 2002-Feb. 2003	2,665.9	1,867.5	27.4 (1.4)	771.0
2003A	Feb. 2003-Jul. 2003	2,748.9	2,245.9	32.7 (1.4)	470.3
2003B	Sep. 2003-Feb. 2004	2,823.0	1,843.8	171.2 (8.5) <sup>(iii)</sup>	808.0
2004A	Feb. 2004-Jul. 2004	2,575.5	2,095.1	16.8 (0.8)	463.6
2004B	Sep. 2004-Dec. 2004	2,394.3	1,970.9	62.9 (3.1) <sup>(iv)</sup>	360.5
<sup>(v)</sup> 2005A	Apr. 2005-Aug. 2005	2,443.6	1,880.3	35.6 (1.9)	527.7
2005B	Sep. 2005-Dec. 2005	2,337.8	1,817.9	24.2 (1.3)	495.7
2006A	Feb.2006-Jul.2006	2,937.4	2,202.6	26.6 (1.2)	707.4
2006B	Sep.2006-Dec.2006	2,071.0	1,587.1	15.3 (1.0)	468.2
2007A	Feb.2007-Jul.2007	3,063.1	2,448.2	17.6 (0.7)	597.0
2007B	Sep.2007-Dec.2007	2,864.4	2,140.2	14.4 (0.7)	709.5
Total		52,885.4	38,888.4	989.2 (2.5)	13,005.8

User Time: Actual beam time for users

(Storage Ring Operation Time)

$$= (\text{User Time}) + (\text{Downtime}) + (\text{Machine Study, Beamline Study \& Beamline Tuning})$$

(Downtime Ratio)= (Downtime) / (User Time) + (Downtime)

(Scheduled User Time) = (User Time) + (Downtime)

(i): Storage ring trouble (RF C-station, vacuum trouble), 2001/6/24 (36:12)

(ii): Storage ring trouble (ID22, vacuum trouble), 2002/6/20 (134:29)

(iii): Linac trouble (electron gun trouble), 2003/9/18 (31:59)

Storage ring trouble (damage of injection vacuum chamber), 2003/10/5 (119:37)

(iv): Typhoon alert, 2004/10/20 (28:36)

(v): The first two cycles in 2005 is dedicated to machine tuning and beam-delivering to beamlines starts at the third cycle.

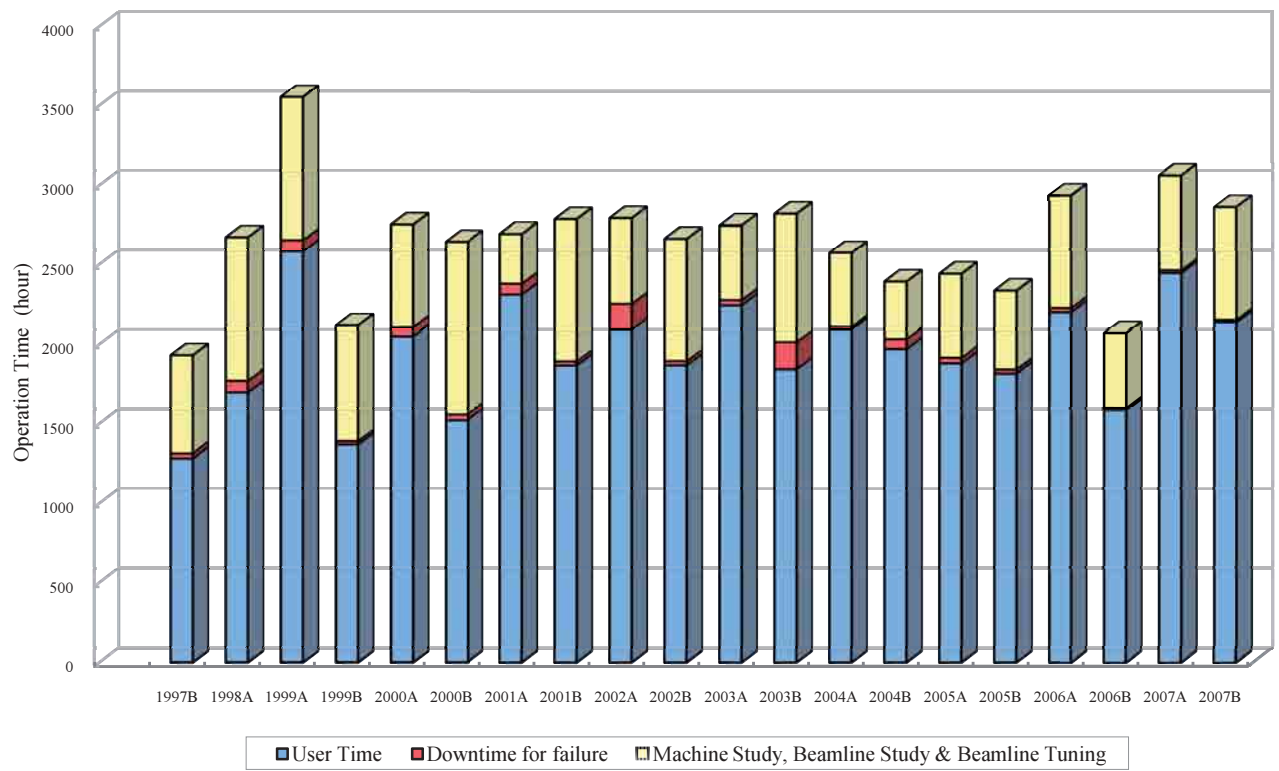


Figure 3-1 SPring-8 storage ring operations (1997B-2007B)