3 PF-AR

3-1 Operation Summary

The full history of the total operation time of the PF-AR is shown in Fig. 1, and the operation statistics of recent six years are summarized in table 1. In FY2012, the scheduled user time was recovered to 3672 hrs and its ratio to the total operation time reached 90 % though it decreased temporarily to about 70 % in FY2011 under the influence of the Great East Japan Earthquake. We could operate the PF-AR storage ring without a serious aftereffect of the earthquake in FY 2012. Both the failure rate and the mean time between failures (MTBF) of the user time recorded the best values in these six years.

The sources of troubles are summarized in table 2. In the previous fiscal year, the outstanding faults other than the earthquake were the magnet (power supply) and the dust trapping.

There are a large number of aged magnet power supplies using since 1980s. So renewal of the aged power supplies continues year by year. The power supplies of the sextupoles were updated in FY2011, and most of the aged quadrupole power supplies of will be updated in FY2013. So the operation of the magnet power supplies is expected to be stable.

In FY2012, we continued the operation with a vacuum problem through the year. The heating up was occurred at the stripline kicker of the transverse feedback system. Abnormal pressure rises were frequently observed during the beam injection or at the maximum beam current. As a symptomatic therapy of this problem, we have reduced the stored current from 60 mA to 55 mA. The abnormal pressure rise was almost controlled by reducing the stored current. It was thought that the reduction of the stored current caused a large decrease of the dust trapping which is the most frequent failure of the PF-AR, and the stripline itself might be one of the sources of micro dusts.

Construction of the direct beam transport (BT) line for the PF-AR has been approved and the design of the new BT tunnel was decided as shown in Fig. 2. The construction of the tunnel will be completed by the end of FY2013. The new BT line can pass 6.5-GeV electron, so the full-energy injection is enabled for the PF-AR. By using additional pulse bending magnets installed in the 3rd switch yard of the LINAC, the continuous injection of the PF-AR will be realized simultaneously with the other three storage rings, two KEKB main rings and PF ring. The installation of the accelerator components of the BT line and the reconstruction of the storage ring to make a new injection part will be accomplished in 2015 in parallel with the commissioning of the Super KEK B factory started from January 2015.

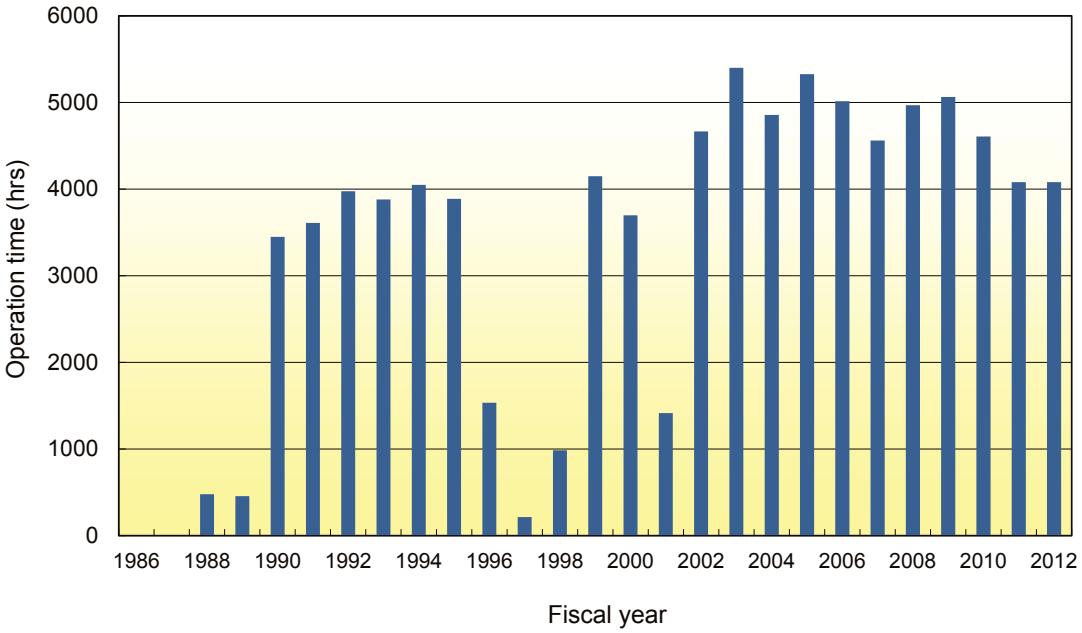

Figure 1: Operation time as a function of fiscal year.

Table 1: Operation statistics and the mean time between failures (MTBF) during FY2005 – FY2012.

Fiscal Year	2005	2006	2007	2008	2009	2010	2011	2012
Total operation time (h)	5313	5016	4561	4969	5063	4608	4080	4080
Scheduled user time (h)	4456	4032	3624	4344	4392	4032	2904	3672
Ratio of the user time (%)	83.9	80.4	79.5	87.4	86.7	87.5	71.2	90.0
No. of failures	79	51	60	40	41	74	49	33
Total down time (h)	69.3	55.1	45.2	41.7	91.0	73.7	38.7	29.7
Failure rate (%)	1.6	1.4	1.2	1.0	2.1	1.8	1.3	0.8
MTBF (h)	56.4	79.1	60.4	108.6	107.1	54.5	59.3	111.3
Mean down time (h)	0.9	1.1	0.8	1.0	2.2	1.0	0.8	0.9

Table 2: Classification of failures based on the source of trouble.

Fiscal Year	2005	2006	2007	2008	2009	2010	2011	2012
RF	12	10	1	4	8	10	5	4
Magnet	4	1	1	2	2	10	8	3
Injection	4	3	8	9	1	6	4	3
Vacuum	2	6	2	0	2	1	0	1
Dust trapping	37	24	39	15	16	24	20	13
Insertion Devices	0	1	0	0	0	0	0	0
Control/ Monitor	4	0	1	1	1	2	1	2
Cooling water	5	1	0	3	4	4	1	0
Safety/ Beamline	9	4	5	5	7	17	3	4
Earthquake	2	0	1	0	0	0	5	3
Electricity	0	1	2	1	0	0	2	0
Total	79	51	60	40	41	74	49	33

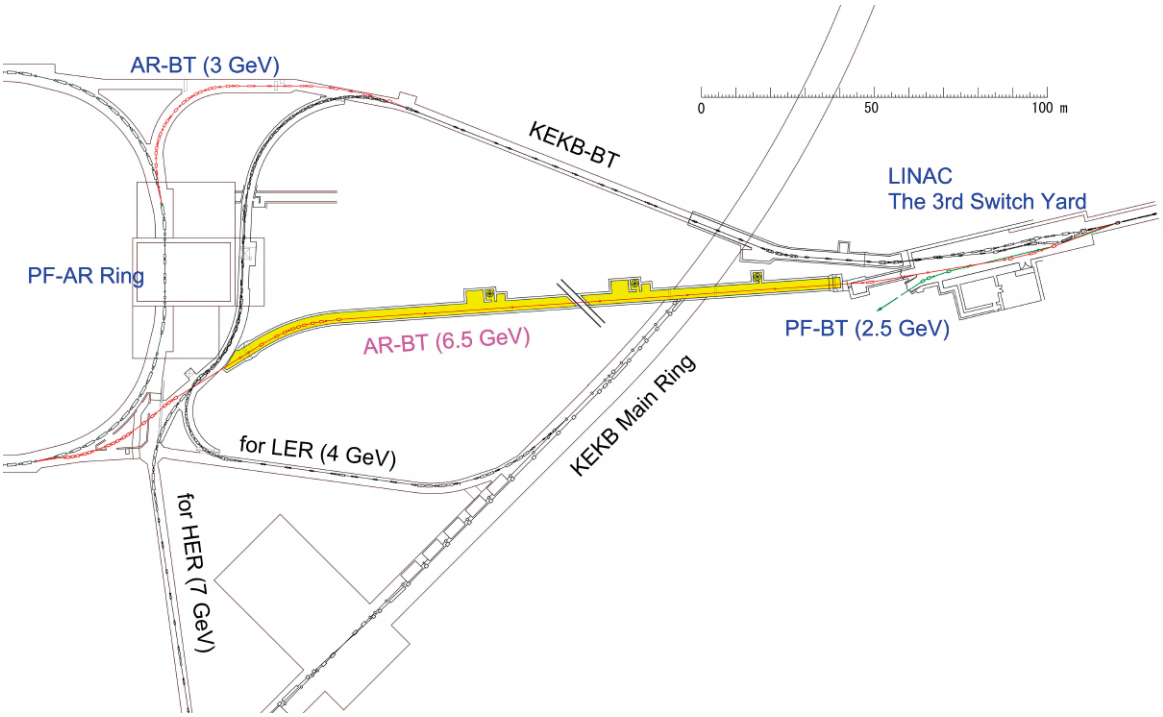

Figure 2: Construction of the 6.5-GeV beam transport line from the LINAC to the PF-AR ring.