

MACHINE OPERATION

The major effort in this year has been to improve the beam performance and to increase the beam availability (the integrated brilliance) as high as possible. SPring-8 is being operated with a maximum beam current of 100 mA, on two- or three-week period for one cycle. The total operation time is about 5050 hours. About 68% of the operation time is available to the users, 23.5% is dedicated to the tuning of accelerators and photon beamlines and the remaining 8.5% is used to the machine studies to improve the beam performance. The beam availability for the users is about 96%, and the remaining time is accounted for by machine failure (1.7%) and beam refill time (2.3%). Figure 1 is the statistics of the machine failure. Half of the failure time is due to failure of the photon beamline's element.

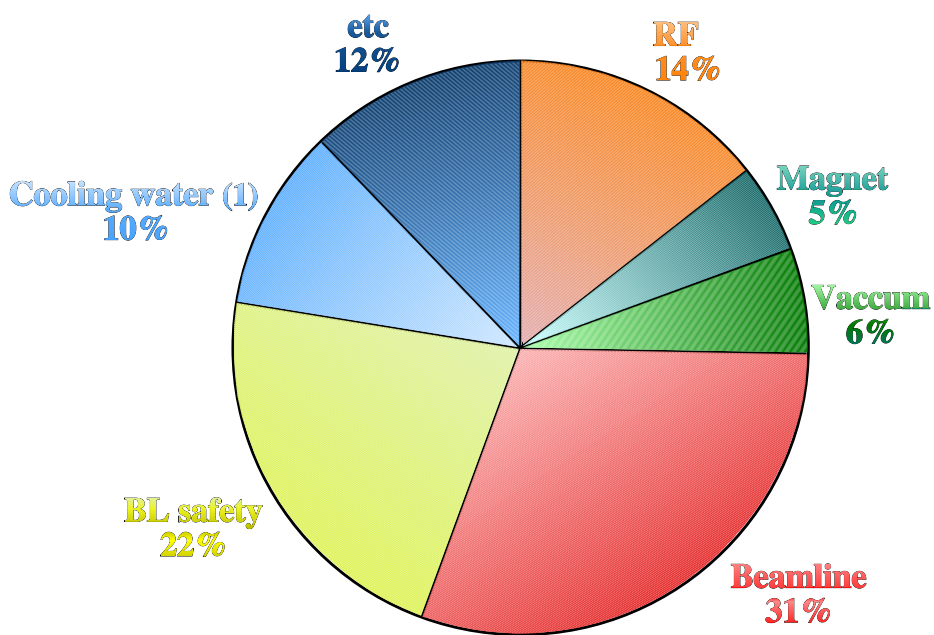


Fig. 1. Failure statistic in 1999.

Filling pattern

The storage ring is being operated using the following three filling patterns:

- multibunch mode with a partial filling, *i.e.*, 24/29 filling
- several bunch mode, *i.e.*, 21 bunch mode (21 equally spaced trains of 3 or 7 bunches)
- hybrid mode, consisting of a combination of several bunch mode and multibunch mode.

These filling patterns can be easily changed by a timing system that is able to select an arbitrary bucket among the RF bucket of 2436 at each injection. 50% of the total user time was operated in the multibunch mode. Partial filling was selected to eliminate an emittance growth of the electron beam due to an ion-trapping effect – 25% was done using several bunch modes and the remaining 25% was done using the hybrid mode. Standard bunch current is 0.05 mA/bunch in the multibunch mode and 0.5 to 2 mA/bunch in the several bunch modes. The maximum bunch current in a single bunch mode is about 16 mA. This current is limited by decreasing of vacuum pressure due to heating of the bellows port.

Electron beam refilling

Electron beam refilling is done twice a day while operating in the several bunch mode and once a day in the multibunch mode. Beam refilling does not always require killing the stored beam. The refill procedure consists of a topping-up, with an injection efficiency of more than 90% under a vertical acceptance of ± 10 mm. Each refilling time is about 25 minutes. The 25 minutes consist of the following activities: 10 minutes for opening of ID's gaps, about 5 minutes for beam injection, and 10 minutes for a fixed-point observation of raw COD and dispersion when all ID'gaps are fully open.