RF System

Masahiro HARA
Hiroyasu EGO
Yoshitaka KAWASHIMA
Yuji OHASHI
Takashi OHSHIMA
Takeo TAKASHIMA

1. Introduction

The remaining sixteen cavities (including tuners and couplers) have been completed, and the low level measurements on RF characteristics of these cavities were carried out. The high power performance of these cavities was confirmed as being capable of feeding as much as 120 kW of power into the individual cavities. After the performance tests, these cavities were installed in the dispersion-free straight section with low betatron function of the storage ring (B and C stations).

2. RF stations

Construction of three RF stations (B, C, and D) was completed. Each station consists of a klystron, its power supply, and high power waveguides, cavity assembly, a low level control system, and a cooling system.
The specifications for major components are as follows[1];

Frequency 508.58 ± 0.5 MHz,
Klystron Toshiba E3786,
RF output power CW 1 MW,
Klystron power supply -90 kV 20 A
without a crowbar circuit ,
Anode modulator(Band C) 0 to - 80 kV,
Circulator 1.2 MW(forward).

The power supply for a klystron is described in the reference[2]. The output power from a klystron is divided into eight using magic-Ts and is fed to eight single-cell cavities.

The low level control system including phase and amplitude adjusting circuits, standard signal source, and interlock circuits was installed[3]. Signal levels were calibrated and the phases (cable lengths) from the pickups of individual cavities were adjusted according to their orbital positions.

The cavity cooling system with a precise temperature control (± 0.1˚C) was constructed for B, C, and D stations.

3. Single-cell cavities

Each station has eight single-cell cavities. Each cavity is equipped with two movable tuners and one fixed tuner, and an input coupler. Eight single-cell cavities were assembled on the girders with input couplers placed alternatively in vertical and horizontal directions [1].

4. Timing system

The 508.58 MHz nonstop synchronous counters have been developed to control the bunch transfer among the accelerators. Optical fibers, E/O (electrical to optical) and O/E modules and other related modules were installed and adjusted. A control center of the timing system was installed in the E station. Beam-filling was investigated in reference[4].

5. Conditioning

Each cavity was baked at 150 ˚C and was conditioned for the input power at as high as 120 kW. The input power was computer-controlled under the setting of two vacuum levels[5]. Couplers were independently conditioned at 300 kW feeding power.

After the installation of these cavities, the overall performance test for each station was conducted. Cavity conditioning is usually done at the maximum input power of 100 kW/cavity (800 kW/station). The control of these RF stations are described in the reference[6].

The cavity cooling system was succesfully operated with its temperature change kept within 0.02 ˚C as long as its power was maintained at the level within 400 kW/station, which is expected at the normal beam operation.

References

[1] H. Ego, M. Hara, N. Hosoda, Y. Kawashima, Y. Ohashi, T. Ohshima, H. Suzuki, T. Takashima, and H. Yonehara ; "Present status of RF cavity vacuum system" in this annual report.

[2] N. Kumagai, C. Yamazaki, and H. Kouzu : "Star-point Control for the Klystron Power Supply in the SPring-8 Storage Ring", Proc. Int. Power Electronics Conf., Yokohama, p1497 (1995).

[3] Y. Ohashi, H. Ego, M. Hara, N. Hosoda, Y. Kawashima, T. Ohshima, H. Suzuki, T. Takashima, and H. Yonehara et al "RF Low Power System for the Storage Ring", in this annual report.

[4] Y. Kawashima, H. Ego, M. Hara, N. Hosoda, Y. Ohashi, T. Ohhshima, H. Suzuki, H. Yonehara ;"How to Make Beam-filling Patterns in the Storage Ring", in this annual report.

[5] T. Ohshima, H. Suzuki, H. Ego, M. Hara, N. Hosoda, Y. Kawashima, Y. Ohashi, F. Wang, and H. Yonehara :" Conditioning of RF Cavities and RF Input Couplers for SPring-8", Proc. 5th EPAC, pp.2047-2049 (1996).

[6] T. Ohshima, H. Ego, M. Hara, N. Hosoda, Y. Kawashima, Y. Ohashi, H. Suzuki, T. Takashima, A. Taketani, and H. Yonehara ; Computer Control of RF System, in this annual report.