# SPring-8 Linac

**Hideaki YOKOMIZO**

## 1. Introduction

The 1 GeV linac consists of a 250 MeV high current linac, an electron/positron converter, and a 900 MeV main linac. In order to avoid ion trapping in the storage ring, the SPring-8 linac is capable of providing the positron beam with the energy of 900 MeV. The electron beam is also capable of being accelerated to as high as 1.15 Gev by extracting the target of the electron/positron converter from the beam line. The linac is capable of producing three types of pulse width such as 1 ns, 10 ns, and 1 μs. These types of pulse width are required as the operation modes of the storage ring; multi-bunch mode and single bunch mode. The linac rf-frequency is 2,856 MHz and its operation rate is 60 Hz at the maximum. The fabrication of the linac components started in l991. Installation of the linac at a planned site started in April l995, and was completed in December l995. Testing of the various types of power supplies started early in 1996, while the beam commissioning started on Aug. 1 and was completed in November l996.

## 2. High-Power Microwave Aging

Microwaves generated in the klystron enter the accelerator column after passing through a window and a wave-guide of approximately 10m long. Since this passage is entirely through a vacuum, the aging process should be conducted while monitoring the vacuum pressure of the path so that the window and the wave-guide are not damaged.

In general, aging requires time and labor. Yet on this particular occasion in which neither labor nor time was available in abundance, we decided to automate the aging operation by the computer. We began the operation with a simple logic, and then tested an interlock logic which is more complicated. We eventually completed an automated aging system that also in corporated a logic for predicting the deterioration of vacuum pressure.

In addition to the automated aging operation proving to be successful, it also has improved the efficiency. We were able to make the whole accelerator system attain a maximum microwave power in 550 hours. This period was much shorter than what had been expected in the beginning. As the result of this efficient operation in the short period aging, we were able to start the beam commissioning in August l996 as scheduled.

## 3. Beam Commissioning

The beam commissioning stated on August 1 with the generation of electrons which were accelerated as far as the first accelerator column on the same day. These electrons were generated from the thermionic cathode assembly heated to a high temperature. It was confirmed that the electron gun as well as the accelerator system were functioning correctly. There was an unexpected failure in the safety control system on August 2 resulting in our spending a few days until August 6 repairing the system.

The operation was restarted on August 7. The electron beam was accelerated up to the 7th accelerator column. The analyzing of the beam by the bending magnet showed that its energy level was approximately 250 MeV. On August 8, the third day of the beam commissioning, the electron beam was accelerated by 26 accelerator columns and projected into the final beam dump. In the beginning, only 5% of the beam was transmitted in the section from the first accelerator column to the final beam dump. By applying several adjustments, however, we were eventually able to transmit 100% of the electron beam to the final dump by August 9.

The phases of the microwaves at accelerator columns were adjusted by maximizing a beam loading of the transmitted power to the dummy loads. The electron beams were generated with different types of parameters, such as a long pulse with a 1 ms width as well as a short pulse with a 40 μs width. The beam commissioning was carried out until the end of December. The final test of a linac system was completed early in November 1996.