Conventional Facilities

Seinojo TAKANO
Kenichi SAKURAI

1. Introduction:

The Utility Control Building (January), Experiment Drainage Treatment Equipment (February), tennis courts (August), Storage Ring building (October), Cafeteria (November), and RI Laboratory (December) were all completed during 1996. Especially in the areas of health and welfare management, two tennis courts are already been used by the tennis club members soon after they were completed and made usable. The cafeteria is also expected to become serviceable soon.

As of December, l996, the following buildings, for which the construction procurement orders had been issued during l995 fiscal year, have been under construction: Main Building, Machine Laboratory, Accelerator and Beamline R&D Facility, Guest Houses, Biomedical Imaging Center Buildings, and the exterior work associated with these buildings. The second stage plan for SPring-8 has also been making steady progress with the expected completion from June through September of 1997. In addition, the construction of the “New Subaru” facility of the Hyogo prefecture (1.5 GeV Synchrotron Radiation facility), which is based in the injector linac of SPring-8, has started last December with the anticipated completion in December, l997.

Also in progress with the anticipated completion in March l997 is the design of the SASE (Self Amplified Spontaneous Emission) Experiment Building and utilities for the New Subaru facility.

2. Facilities Summary

Since the details of buildings and utility facilities that were completed or started before 1995 have already been described in our Annual Reports'94 and '95, summaries will be given in this section only for the SASE Experiment Building and the Biomedical Imaging Center, for which the design activities are currently in progress.

2.1 SASE Experiment Building

In addition to the electron beam incidence to the storage ring building, the injection accelerators of SPring-8 has been constructed with the view towards future expansion. The expandable transport lines exist in three locations such as the electron and positron converter section, the linac beam dump section, and the synchrotron beam dump section. The SASE experiment building will be erected in the transport line from the linear accelerator beam dump section. This particular transport line is further branched out into the New Subaru, and there are two new transport lines under design, which are planned for the future.

The SASE experiment building will be added to the linac tunnel, which has been serviced as the Accelerator and Beamline R&D Facility. The electron beam tunnel is a reinforced concrete structure with inner dimensions of 5.0 m width (utility space side of 2.0 m width plus maintenance space side of 3.0 m width) and 3.5 m high. It is shielded by a 3.0 m thick normal concrete wall. Although the electron beam tunnel is 50 m long, it also has another 17 m of extensible space for the measuring as well as conducting experiments with the emitted laser beam.

The building prepared for the SASE experiments consists of the Accelerator and Beamline R&D Facility and the building that connects the New Subaru and linear accelerator buildings. It contains the SASE transport tunnel (L4TPT), the New Subaru transport tunnel (L3TPT), the associated power supply rooms, etc.

The L4TPT is approximately 60 m long, the inner dimensions of which is 4.3 m wide (utility space side of 2.0 m width plus maintenance side width of 2.3m) and 3.5 m high, and it is shielded by the 3.0 m thick normal concrete wall (a part of which is made of heavy concrete of 4.8 specific gravity). This tunnel can accommodate two more future transport tunnels. In order to save construction costs, the tunnel's ends, where the two future transport tunnels will be connected, are made of concrete shielding blocks which will be cast on site, and will be easy to remove after their use is completed. The load of one such concrete block is estimated to be 80 tons. The immediate use of L4TPT is for research to improve the performance of the accelerator by installing two accelerator tubes (3.0 m /piece) and the beam dump. In order to accomplish this task, L4TPT has penetration holes for utilities and beam dump pit (1.0 m wide, 5.0 m long and 2.0 m deep). Moreover, since this dump pit will become unnecessary during the SASE experiment, it is designed to be filled up with concrete. Another interesting feature of this tunnel is that its emergency exit is constructed in the form of a labyrinth. Supplementary rooms for this tunnel are the klystron room on the first floor, and the power supply room for machines,cooling system room, electric equipment room, and ventilation fan room on the second floor. All of these rooms constitute a building that generally covers the upper part of the tunnel, which is approximately 600 m^2. For the sake of usage convenience, except for the shower rooms, these rooms are all planned as radiation control area. The ventilation fan room is so designed as to be highly efficient in handling the combined exhaust air from the SASE and New Subaru tunnels. The drainage from the radiation control area will be stored temporarily in the DP tank of the DP Tank Room located adjacent to the tunnel before it is discharged to the drain pipes for the experiments.

L3TPT is approximately 70 m long and its inner dimensions are 2.5 m width (utility space side width of 1.0 m plus maintenance space side width of 1.5m) and 2.5 m high, and is shielded by the 0.45 m thick normal concrete. This tunnel is so designed as to be able to conduct research that uses electron beam and synchrotron radiation (New Subaru Long Undulator) in addition to using the beam transport line for the New Subaru. The supplementary facility for this tunnel is the monitor room which serves as the emergency exit.

In order to save construction costs, the radiation shield is mainly made of normal concrete (specific gravity of 2.2). Yet heavy concrete is used at the tunnel's future transport line. This design is to reduce the building area in order to satisfy the provisions for the required shield thickness and the beamline positions. Because of the difficulty in obtaining appropriate concrete aggregates to achieve the necessary radiation shielding, the Japan Atomic Research Institute traditionally uses heavy concrete of specific gravity of 3.4 for radiation shielding consisting of magnetic iron ore as the basic aggregate. Yet in this tunnel, the same weight concrete as used in the linear accelerator will be used, which uses red iron ore as the coarse aggregate and magnetic iron ore for the fine aggregate to achieve the optimum grain size distribution so that its weight approximately corresponds to the concrete of "slump =0." Moreover, slump=8 is achieved by the use of a concrete pumping truck for the concrete costing work, and employing the ultra high performance dehydration agent. In order to confirm that there is no separation of concrete from aggregates during the concrete costing operation, several test specimens were taken to examine its structure. There was no visible separation found in these specimens, and this validates the good construction result.

*2.2 **Biological Imaging Center***

In the Biological Imaging Center, synchrotron radiation is used to conduct research on image information processing, which is needed for clinical experiments as well as for biomedical research. The facility is, therefore, so designed to maintain the efficiency and safety in the use of synchrotron radiation for image processing research and developmental work, and for clinical experiment research.

This facility includes an experimental building that introduces three medium long beamlines (BL20IN, BL20B2, and BL21IN) located at the west side of the storage ring, and two research buildings in which experimental data are analyzed. This facility is positioned approximately 200 m away from the light source. These two buildings are the two story reinforced concrete structures with a total floor area of 2,502 m^2 and 2,323 m^2 respectively, and they are connected to each other by the second floor passageway. Moreover, it is planned that the vacuum chamber to the experimental building will be exposed to the outdoors and will be surrounded by the boundary fence of the radiation control area. In order to achieve this plan, the ground is divided by the 100 m long beamline installed approximately 1.4 m higher than the ground level.

The shape of the experimental building is somewhat constrained by the three beamlines coming from the storage ring, and its plan view shows a protruded form. The first floor of the experimental building is the experimental zone that is roughly divided into two zones; basic research zone (consisting of corridor 1 through corridor 7, beamline and irradiation rooms,etc.) and the clinical experiment zone (consisting of corridor 7 through corridor 10, angiography, monochromatic X-ray CT chamber, photographic image analysis chamber, and other medical related rooms). The clinical experiment zone is so designed that it can be converted into an independently operated medical care facility. The second floor of the building is the service facility area such as the electricity and machine room.

In addition to the medical research laboratories, the research building is composed of the radiation control room, data processing room, seminar room, etc. These rooms are outside of the radiation control area. Since these rooms are more like researchers' rooms than laboratories, they are planned as a separate building. Since many visiting researchers will be using these rooms, they are designed to follow the basic philosophy in that they should be bright and compact.

In order to avoid the access to the basic research zone from crossing the clinical experiment zone, these zones are connected by the second floor passageway as mentioned earlier.