Introduction

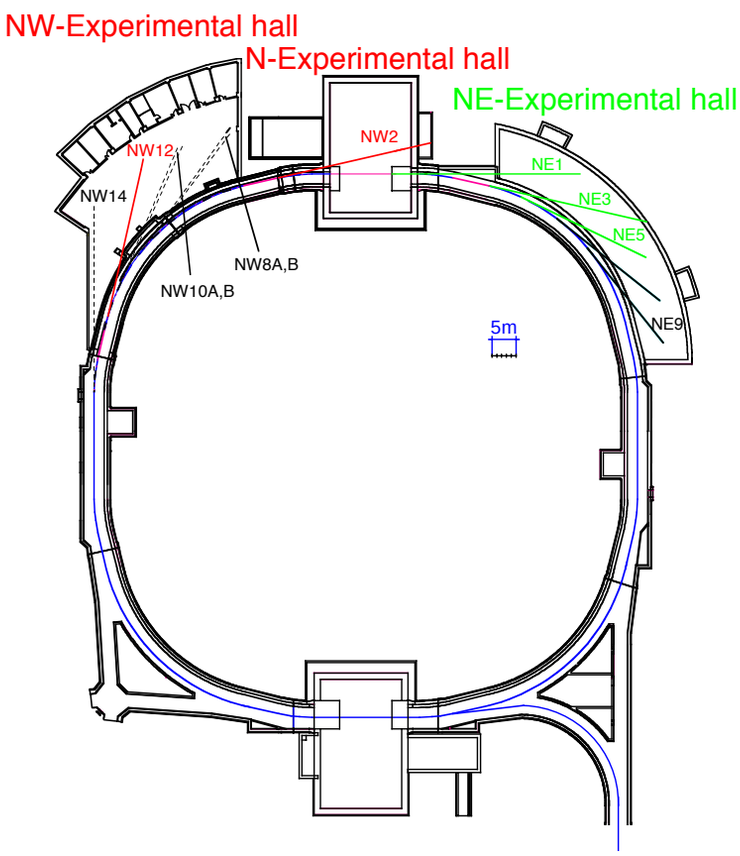
We have welcomed the new century with some good news for the Photon Factory (PF) in the fiscal year 2000 (April 2000 – March 2001). It was the 19th year of the synchrotron-radiation experiments at the PF and I believe that we have taken some steps toward the next decade.

The Structural Biology Group lead by Prof. Wakatsuki was formed to promote in-house staff activity in this field. Eight members are in the group (Fig. 1) and one more staff member is being recruited. At the same time, “Structural Biology Building” (Fig. 1) was built in March, 2001. I believe that activities in the field of strucural biology will be very productive in FY2001.

Tadashi Matsushita

Figure 1.
(Upper) Staff members of the Structural Biology Group.
(Lower) Newly constructed “Structural Biology Building” with a fine view of Mt. Tsukuba.

As reported in the previous volume, the PF-AR (PF Advanced Ring; 6.5 GeV) upgrading project has begun. The vacuum system of the PF-AR is to be upgraded during the 10-months shutdown (March – December, 2001) to improve the lifetime of the stored electron beam. New copper vacuum ducts have already been brought in and are now being installed into the ring tunnel. In the fall of 2000, a supplementary budget was approved by the government for constructing a new 1280-m^2 experimental hall building at the northwest corner of the PF-AR. Two X-ray undulator beamlines (NW2 and NW12) for XAFS spectroscopy and protein crystallography were designed and the beamline components are now under construction. As shown in Fig. 2, NW2 is in the north experimental hall and NW12 is in



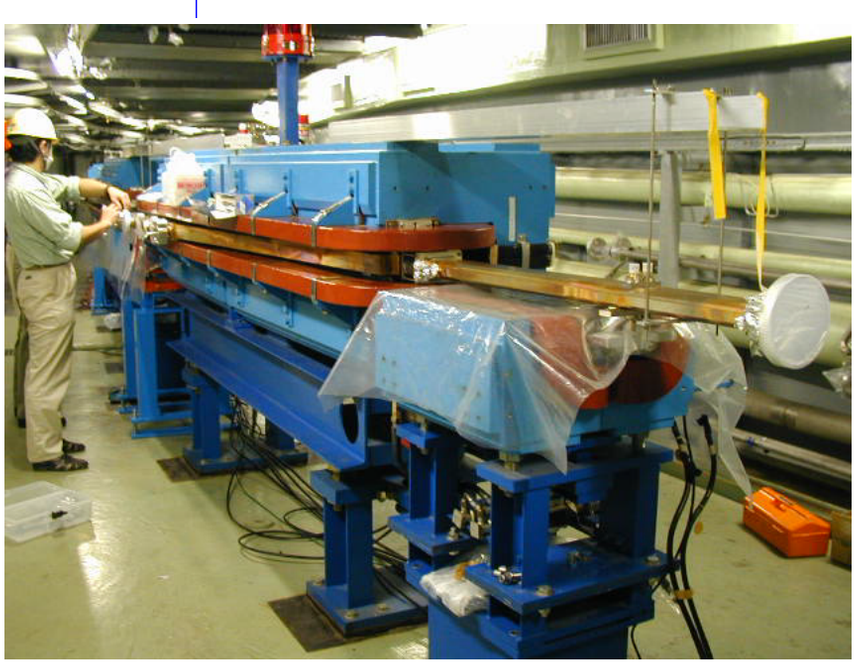


Figure 2.
(Above) Plan view of the PF-AR with the new NW experimental hall and undulator beamlines.
(Right) Installation of the new copper duct into the PF-AR bending magnet.

the northwest. These beamline components will be installed during the 10-months shutdown. Together with the two existing insertion-device beamlines (NE1 and NE3), four insertion-device beamlines in total will be operational by the summer of 2002. In the NW experimental hall, there will be a space for installing another insertion-device beamline. The details of the PF-AR upgrading project are described in ACCELERATORS and EXPERIMENTAL FACILITIES sections.

In FY2000, steady and stable operation of the PF facilities has been achieved. The total operation time of the PF Storage Ring (2.5 GeV) and the PF-AR (6.5 GeV) were 5,562 and 4,064 hours, respectively. More than 2,300 users visited the Photon Factory repeatedly, resulting in accumulated number of visiting person-days of 33,897. In parallel with the facility operation, continuing efforts to improve and/or upgrade the existing facilities have been made.

The light source division also continues in efforts to realize more stable and long-life electron beams in the PF Storage Ring. In this regard, photon and electron beam monitors, bunch oscillation, beam instabilities are reported in ACCELRATORS section.

In the experimental hall of the PF Storage Ring, three bending-magnet beamlines have been rebuilt or upgraded and a multipole wiggler beamline was upgraded. A bending magnet beamline for studies on structural physics is under construction by two new-type collaborations between several institutes. These beamlines are described in EXPERIMENTAL FACILITIES section.

Scientific activities are expanding into various fields. Some remarkable activities are presented in the HIGHLIGHTS section.

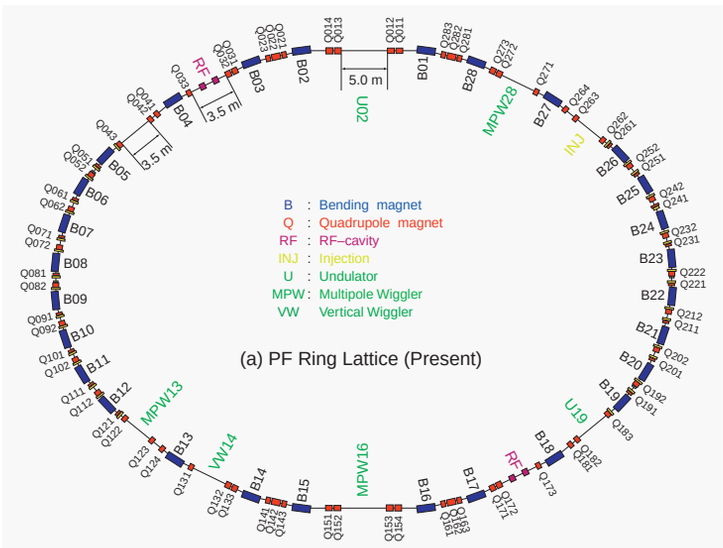
Very tiny samples can be satisfactorily studied on beamlines at the second-generation synchrotron radiation facilities like the PF if proper optics and instruments are used. X-ray diffraction study from a very small area of heated diamond anvil cell has been made on a multipole wiggler beamline where a new focusing optics is adopted. Even on a bending-magnet beamline, atomic structures of small interplanet dust particles have been studied.

Structural studies of proteins are major parts of biological science activities in the PF. Bending magnet stations at the PF are still very productive in this area as is reported in 8 of the HIGHLIGHTS section. Aiming at a more efficient data collection system for structural determination of proteins, we are also planning to construct a few more insertion device beamlines for protein crystallography.

With a two-dimensional imaging system having a recording rate of 10 images/s, 21 patients received coronary angiography investigation in the fiscal year 2000. With fewer burdens of patients and the dynamic nature of the system, the method was evaluated clinically useful.

In-situ experiments are becoming attractive and useful in recent materials science. Such examples are given for electrode of Li-ion battery and also for oxidization process of silicon surface.

The 3.6 m long undulator beamline emits radiation with a brilliance of 1×10^{18} photons/s/mm^2/mrad^2/0.1%b.w. X-ray Raman scattering experiments make a full use of such a high brilliance as reported in 4 of the HIGHLIGHTS section. Circularly polarized undulator radiation on BL-28 was effectively used for the study of photoelectron angular distribution from oriented N_2 molecules. Importance of undulator beamlines is continually increasing and we are discussing construction of an undulator beamline for alternating polarization of soft X-rays.



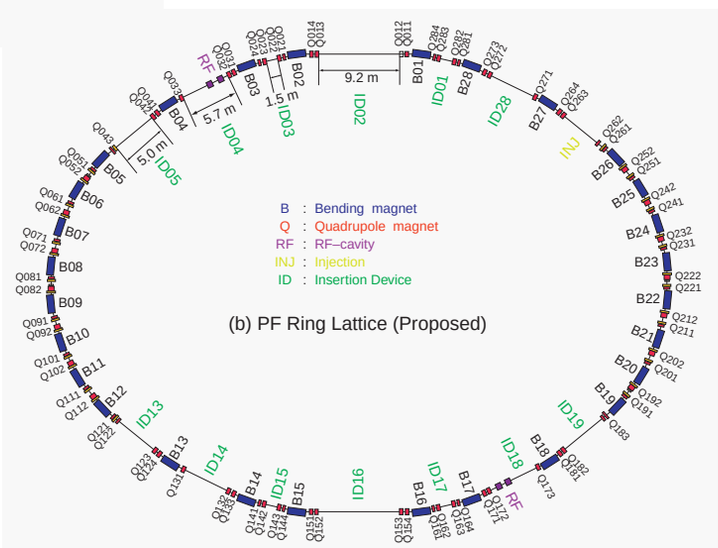


Figure 3.
(a) Present and (b) proposed PF ring lattice. This modification lengthens the seven existing straight sections and creates seven straight sections.

In order to meet strong demand for more insertion-device beamlines, we are proposing a future upgrade of the PF Storage Ring to create seven new straight sections and to lengthen existing seven straight sections (Fig. 3). If such an upgrade be realized, we shall be able to have a total of 19 straight sections for insertion devices with those 14 on the PF ring and 5 on the PF-AR.

The Photon Factory encourages users and staff members to have workshops and seminars in related fields. Four workshops and 15 seminars were held in FY2000.

In March, 2002, the Photon Factory will have the 20th anniversary since the first observation of synchrotron radiation at the PF Storage Ring. FY2001 is the year for preparing not only for the 20th anniversary, but also for the next decade of the Photon Factory. We are also preparing for a review on the facilities and activities of the Photon Factory by an external committee. This would be useful in establishing strategies for our future directions.

We would like to provide many opportunities for scientific activities at the PF to a large number of researchers in the most effective way. Your comments on the PF are always welcome.

T. Matsushita

Tadashi MATSUSHITA
Deputy Director of IMSS