

Introduction

The fiscal year 2010 was an extraordinary year for the Photon Factory. The immensely destructive earthquake on March 11, 2011 and the events which followed have left far reaching effects. Although this Annual Report covers the period until March 31, we describe here the recovery processes up to summer 2011. The damages inflicted on the Tsukuba Campus made it impossible to operate the PF rings for the spring run. We immediately had to announce the cancellation to the users. During the first week or so there was no power and we had to inspect the damages with torch lights. As soon as the power came back, despite only 2 MW for the entire KEK Tsukuba campus for many weeks, we started checking the two rings, beamline components and equipment. There were wide scale damages in the LINAC including a fall of Q-magnet. A video recording showing the extent of the movements of the LINAC components, being recorded by chance by a person in the KEK Accelerator Laboratory at the time of the earthquake, shows how damaging it was to the machine which had been installed and maintained with care and precision. The half of the PF 2.5-GeV ring lost its vacuum while the PF-AR ring sustained its vacuum. Soon after the earthquake, we received a very large number of supports from all around the world. One of them was an offer of technical supports from the leading synchrotron accelerator physicists lead by Dr. Hiromichi Kamitsubo of Saga Light Source. They visited us on April 5th to inspect the extent of the damages, which were not as extensive as they had expected. Nonetheless, they discussed how best they could help the Photon Factory's recovery process.

With the power back, the recovery process accelerated although the condition was still harsh without enough electronic power; no heating, no water, very little light. With the highest level of supports from within KEK, we could make initial repairs to the rings and beamline components, and became ready for electron beam injection to the two rings in May, which was followed by recommissioning and successful electron beam storing in both rings. Beamline checkups followed the ring recommissioning and by late May we could bring X-ray beams to almost all the beamlines. We then invited experienced users to test the beamlines with the PF staff. The test beamtime lasted 6 weeks until the morning of July 7 and was extremely useful for us to establish what additional work was needed to be fully operational before the autumn run. It could also give "test" beamtimes to users for real experiments. During the summer shutdown we worked on the problems identified during the "test" beamtime in preparation for full operation in October 2011. We cannot thank enough to all the people who supported the



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recovery processes.

Another extraordinary help came from the other synchrotron facilities around the world. During the first several days we did not have the KEK mailing system and were isolated from the rest of the world. As soon as the KEK mailing system recovered we saw a very large number of consolation emails from many SR facilities and universities, both domestic and overseas. It soon became clear that it would take me many weeks to write reply letters, so I sent a short report to CCP4BB, a bulletin board shared by protein crystallographers worldwide, explaining the situation of the PF and mentioning a possibility of shortage of beamtime for Japanese users. The email message was forwarded by those who read this to many facilities, and other bulletin boards, resulted in an even larger number of emails. Many of them were from the facility directors who generously offered help with beamtime on behalf of the PF users. In particular, SPring-8 created a scheme to help users of quantum beam facilities affected by the earthquake. They set aside 500 hours of beamtime (250 for half a year) at each beamline for users from affected facilities. They also kindly let the Photon Factory staff use one of the offices at SPring-8. Altogether domestic SR facilities provided beamtime for more than 100 experiments in the months after the earthquake. The overseas facilities were equally supportive for our users. In many cases, they offered beamtimes to PF users by accepting active PF beamtime proposals without reevaluating science merits. Although the PF beamline staff were busy recovering the beamlines, they also went to the SR facilities to help PF users perform experiments. The PF also provided financial supports for these users doing experiments within Japan as in the normal PF experiments. As for experiments at overseas facilities financial supports were provided to a limited number of users due to the financial constraints. We heard from many PF users that these "off-site" experiments were extremely useful for them to carry on research while the two PF rings were unavailable during the recovery. We would like

to express our deepest gratitude to all these facilities who offered our users beamtime during these difficult times.

FY2010 was the fifth year of the current PF management. During the last 5 years, we have made major efforts to reinvigorate the facility with new science and user programs as well as the industrial partnerships. We first established the 6 areas of excellence ((1)strongly-correlated electron systems, (2) materials under extreme conditions, (3) novel material device, (4) environment, energy and rare materials, (5) structural biology of large molecular machinery, and (6) chemical reactions) to focus the limited resources and reinvigorate the then 24-years old facility. We prepared a beamline refurbishment plan to reduce the number of stations from 70 to 50 by closing 30 stations and building 10 new, which required complex and lengthy discussions with the PF users. We made a strong case to develop insertion device beamlines with the emphasis on taking advantage of the energy of the PF 2.5-GeV ring, dedicating most of the medium to long straight sections to VUV-SX applications, and transferred beamlines requiring hard X-ray beams to the PF-AR 6.5-GeV Ring. Two notable examples are BL-16A with a fast-switching circularly polarized tandem APPLE-II undulators for XMCD experiments and transfer of high pressure activities to AR-NE1A beamline and medical imaging AR-NE7A beamline on the PF-AR 6.5-GeV ring.

Following the request from the Pohang Light Source to SR facilities in Asia and Oceania, the Institute of Materials Structure Science (IMSS) and the PLS signed a memorandum of understanding to facilitate the use of the PF by the users of the PLS during their shutdown for upgrade. After several visits by the PLS staff we agreed on the protocol for beamtime applications using the normal PF-PAC procedure with special attention to the PLS users. We received 54 beamtime applications for the second half of FY2010 and 42 for the first half of FY2011, which corresponds to about 25% of the size of the PF-PAC applications.

As part of the PF-ISAC activities, two subcommittee meetings were held towards the end of FY2010, Materials Chemistry Subcommittee meeting on February 21-22, 2011 and Condensed Matter on March 1-2, 2011. The members of the former committee were Prof. Y. Iwasawa of the University of Electro-Communications (chair and a member of the PF-ISAC), K. Janssens (University of Antwerp), M. Newville (University of Chicago), S. Pascarelli (ESRF), M.C. Ridgway (Australian National University), and Y. Takeda (Nagoya University, absent from the meeting). The committee surveyed and discussed the activities in XAFS and X-ray fluorescence/micro beam analysis on a large number of beamlines. While they commended the staff for their efforts on the large scale beamline operation, in-house research and securing external funding, they also advised the management to pay

attention to the chronic staffing problem and emphasized the importance of strategic planning for the future.

The subcommittee on Condensed Matter reviewed the activities of the Condensed Matter Group, i.e. subset of the Condensed Matter Research Center both of which are led by Prof. Y. Murakami, and the relevant beamlines. Prof. J. Mizuki (Japan Atomic Energy Agency) chaired the committee which consisted of Drs. M. Takata (RIKEN/JASRI), K. Shimizu (Osaka University), J. Hill (BNL, absent from the meeting), R. Feidenhans'l (University of Copenhagen), and Y. Wang (University of Chicago). The group's activities in strongly correlated electron systems and high pressure were evaluated very positively for the high impact outputs while the staffing issues on the beamline and the long-term stability with competitive external grants were noted as concern. They also encouraged closer collaboration with other groups of the PF in particular the Electronic Structure group. These suggestions from the two subcommittees have been followed in terms of inter-group activities and new recruitments.

On the interface with users, we transformed the PF Symposium, our annual users meeting, to a truly scientific forum to discuss latest results from experiments performed at the Photon Factory, which now attracts 350 to 400 participants with 300 poster presentations, more than doubled from 5 years ago. We also started a facility information page in Journal of Synchrotron Radiation from the July 2010 issue, twice a year. With all these efforts there has been a marked increase in the number of unique users from 3150 in FY2006 to 3450 in FY2010.

There has been a steady progress in the compact ERL project. The drive laser system has been set up at the North Building of the PF-AR. The East Counter Hall has been renamed as ERL Test Facility in which the cERL will be built. The building did suffer some damages from the earthquake on March 11, which delayed the construction process. It now houses a clean room for developing the ERL superconducting cavities, cryogenic system, laboratories for control systems. The development project will further accelerate during 2012 and commissioning of the beam expected to start by the end of March 2013.

The ERL project has also made a major step forward in 2011. After the earthquake, we discussed intensively how to accelerate the project and bring forward the target year of operation from 2024 to 2019. The original plan was to build a 5 GeV ERL, but in April 2011 we proposed to change the energy from 5 GeV to 3 GeV in order to fulfill science needs in the soft X-ray regime, for which Japan still does not have a high brilliance SR source. The reduction of energy is also expected to reduce the cost to a level which is more accessible. The change of the ERL energy immediately changed the landscape of the ERL

project and discussions with various parties accelerated.

On December 7-8 2010, the IMSS held an annual IMSS Symposium to discuss sciences using SR, neutron, muon and slow positron beams. This year we combined this with DESY-KEK collaboration meeting and invited leading scientists from DESY and CFEL in Hamburg. The speakers included Drs. Edgar Weckert (DESY) on PETRA-III, Henry Champan (CFEL) on XFEL applications and Heinz Graafsma (DESY) on detector developments. We also invited two speakers to discuss XFEL-O, a second phase of the ERL project, Yuri Shvyd'k from APS on the progress of diamond optics and Alfred Baron from SPring-8 on possibility of inelastic scattering experiments using XFEL-O.

We also hosted an annual meeting of Japanese Society for Synchrotron Radiation Research (JSSRR) and association of Japanese SR facilities on January 7-10, 2011 in Tsukuba International Congress Center. More than 653 participants, the highest in the history of JSSRR meetings, and 53 industrial exhibitors joined the meeting to discuss sciences and technology advancements. Highlights of the meeting were 6 micro-symposia and two plenary lectures by Prof. Makoto Fujita of the University of Tokyo on supramolecular complexes and by Prof.

John Spence of Arizona State University on femtosecond nanocrystallography. In addition we organized a special symposium for non-expert audience with lectures by four leading scientists, Profs. Yasuhiro Iwasawa (the University of Electro-Communications), Masaharu Oshima (the University of Tokyo), Junji Urakawa (KEK), and Kazumi Nishijima (Mochida Pharmaceutical Co. Ltd.).

Finally, an important change is taking place with the PF Users Organization (Kondankai). In the meeting on June 15 & 16, 2010 the PF-ISAC suggested that the low coverage, about 20% of the PF users, of the PF Users Forum (Kondankai) needs reevaluation in order to become more effective in assisting the PF in the ERL development. Since then PF Users Forum discussed extensively its transformation to PF Users Association (PF-UA) in which all the PF users become members automatically in order to represent the entire PF users community. This transformation is expected to be put into practice by the end of FY2011. We very much hope that it will strengthen the channels between PF users and the facility, and help accelerate the 3.0 GeV ERL project.

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