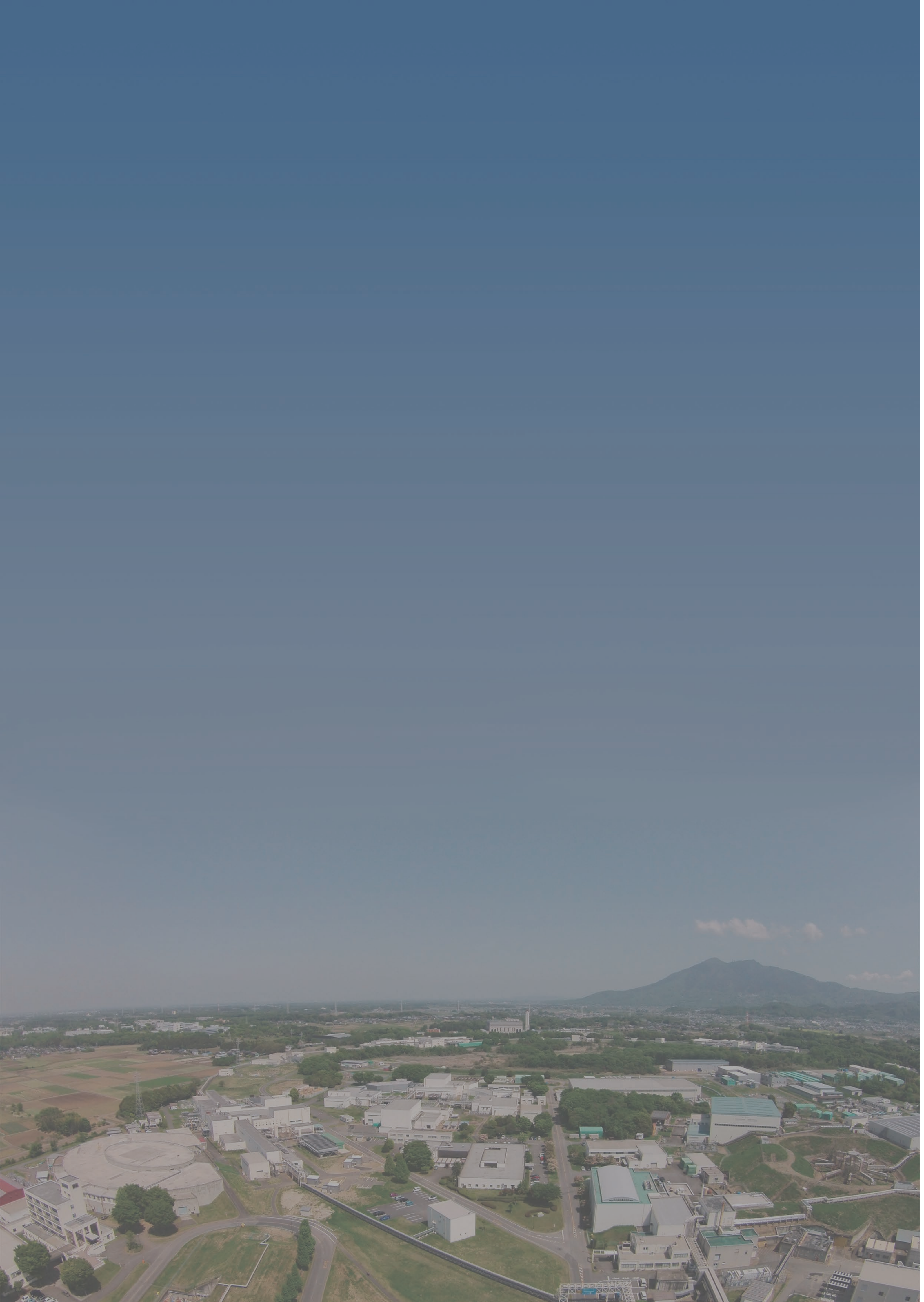
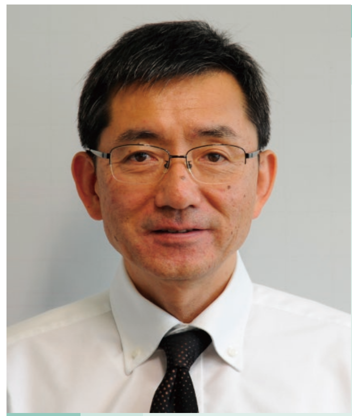


PREFACE



On behalf of the staff of the Photon Factory (PF) we are pleased to present PF Highlights 2015, which is newly published based on the traditional PF Activity Report. The PF Activity Report contained scientific highlights, facility reports, statistical data, and users' reports. From the PF Activity Report, we have selected the best scientific results to produce PF Highlights 2015. We hope that many people will read the PF Highlights to know about the latest topics in synchrotron radiation science from the PF, including slow positron science. This PF Highlights 2015 covers research activities carried out in fiscal 2015 (April 2015 – March 2016), and includes 34 scientific highlights from six research fields as well as statistics on "Operation and Proposals".

The PF leadership has changed slightly. Prof. Kenta Amemiya joined us as Head of Synchrotron Radiation Science Division 1 from April 2015. We are currently operating two storage rings, the 2.5-GeV PF ring and the 6.5-GeV PF-AR (PF-Advanced Ring), to promote inter-university collaboration and encourage joint research projects. In FY2015 we had about 950 active approved proposals, 3,100 registered users and about 480 publications. The PF is also participating in the following large national projects of the Ministry of Education, Culture, Sports, Science and Technology: "Elements Strategy Initiative to Form Core Research Centers", "Platform for Drug Discovery, Informatics, and Structural Life Science", "Photon and Quantum Basic Research Coordinated Development Program", "Cross-ministerial Strategic Innovation Promotion Program", and "Impulsing Paradigm Change through Disruptive Technologies Program". The PF is also serving as an administrative facility in the Photon Beam Platform to open up new research fields for industrial use. Moreover, we are promoting international collaboration: the Indian beamline was established in 2009 after both the Indian and Japanese prime ministers welcomed it in a joint statement. This beamline is actively being used, making the project highly successful.

Over the past decade we have actively been upgrading the beamlines to focus on important scientific areas. In the long straight sections of the PF ring we have installed new undulators and reconstructed the VUV and SX beamlines: BL-2A/B for surface and interface science, BL-13A/B for surface chemistry, BL-16A for surface spectroscopy with polarization switching, and BL-28A/B for strongly correlated electron science. Meanwhile, we have upgraded the hard X-ray beamlines to support the large number of X-ray users and gain long-term competitiveness in the field of X-ray science by installing short-gap undulators in the short straight sections of the PF ring: BL-1A for protein crystallography, BL-3A for structural science, BL-15A for XAFS and small-angle scattering, and BL-17A for protein crystallography. In the PF-AR, we are focusing on hard X-ray activities such as high-pressure, time-resolved experiments. Thanks to the systematic reconstruction of beamlines we have succeeded in reducing the number of stations from 72 (FY2005) to 39 (FY2015) in the PF ring with no loss of productivity.

FY2015 has been a very special year for the PF because the future plan has been officially reconsidered. The PF was constructed as a second-generation synchrotron radiation source and the first photon came out in 1982, and so the PF is now one of the oldest large synchrotron radiation facilities in the world. Accordingly, there is an urgent need to proceed with plans for the next light source facility. The High Energy Accelerator Research Organization (KEK) earlier constructed and operated a compact energy recovery linac (cERL), for conducting R&D on the ERL as a future light source and to evaluate its feasibility. With the recent progress in accelerator technology, however, it has become clear that most of the contributions to photon science expected from the ERL can be realized more quickly by building a 3 GeV-class storage ring-type high-brilliance light source. Accordingly, KEK has halted studies on the ERL as a next-generation light source and has decided to aim for early realization of the storage ring-type high-brilliance light source. This next-generation light source will achieve spatial resolution of the order of nanometers and energy resolution of the order of meV. It will make possible previously unachievable new research in several areas such as studies of the structural and electronic properties of heterogeneous substances, and clarification of chemical reaction dynamics that include fluctuations. KEK is starting specific considerations of an all-Japan effort to realize the high-brightness light source, which will become an indispensable tool for leading-edge research in a wide range of academic and industrial fields.

Youichi Murakami