# Plan of Beamlines in Phase II at Taiwan Photon Source

During three decades since the feasibility study for the construction of the Taiwan Light Source (TLS) in 1981, NSRRC has evolved into a light source facility well known internationally. With both rapid advances in the international scientific community and increasing demands from users for bright X-rays to facilitate their innovative scientific experiments, the NSRRC plans in 2015 to complete commissioning of its newly constructed 3-GeV low-emittance synchrotron light source, the Taiwan Photon Source (TPS). The lattice of the TPS storage ring comprises 24 double-bend achromatic cells with six-fold symmetry. There are six straight sections of length 12 m, and eighteen standard straight sections of length 7 m. The natural emittance of the TPS is 1.6 nm-rad with a small dispersion in the straight sections.

The TPS will open avenues for novel scientific opportunities and experimental techniques. Seven TPS phase-I beamlines are being constructed, including for protein microcrystallography, resonant soft X-ray scattering, submicron soft X-ray spectroscopy, coherent X-ray scattering, submicron X-ray diffraction, X-ray nanoprobe, and temporally coherent X-ray diffraction. The construction of these phase-I beamlines will be completed in 2016. To use fully the superior characteristics of the TPS, the NSRRC proposes a plan of TPS beamlines for phase II. Frontier techniques, such as X-ray imaging, nanoscopy, high-resolution diffraction, and high energy-resolution spectroscopy, have been identified to drive novel science at the TPS. The plan of phase-II beamlines comprises newly constructed and relocated beamlines; an emphasis has been placed on new facilities for high-impact science and a smooth transition from the TLS to the TPS. Three new beamlines including soft X-ray tomography, biological small-angle X-ray scattering (BioSAXS), and nano-focusing angle-resolved photoemission spectros-

copy (nanoARPES) will be in the first group of the plan. In addition, fifteen TLS beamlines will be upgraded and relocated to TPS with the second group.

The design and construction of eighteen beamlines are scheduled from 2016 to 2022. Beamlines of high-resolution powder X-ray diffraction (HR Powder XRD) and X-ray absorption spectroscopy (XAS) at the TLS will be upgraded and moved to the TPS in the first three years. Beamlines in phase II are categorized into new and relocated with upgrade as follows.

Three new beamlines:
(1) Soft X-ray tomography, BM
(2) BioSAXS
(3) NanoARPES

Fifteen relocated/upgrade beamlines:
(4) XAS (17C), BM
(5) HR Powder XRD (17A)
(6) Micro-crystal diffraction (17B)
(7) Soft X-ray nanoscopy (EPU/PEEM)
(8) Soft X-ray spectroscopy (24A)
(9) Powder XRD (01C2)
(10) Advanced micro-focus protein crystallography (PX) (13C)
(11) X-ray spectroscopy (SP8)
(12) TXM (01B), BM
(13) Tender (16A), BM
(14) PX (15A)
(15) Scattering (07A)
(16) SAXS (23A)
(17) PX (13B), BM
(18) Dragon (11A), BM

For the relocated beamlines, the corresponding beamline numbers at the TLS are indicated in parentheses.

The principle of beamline planning in phase II of the TPS is to strengthen the experimental techniques that are not included in phase I, such as imaging and spectroscopy on nanometer scales. The relocation strategy from the TLS to the TPS aims to achieve a smooth transition that maintains the overall scientific output and enhances the quality of work performed at the NSRRC.

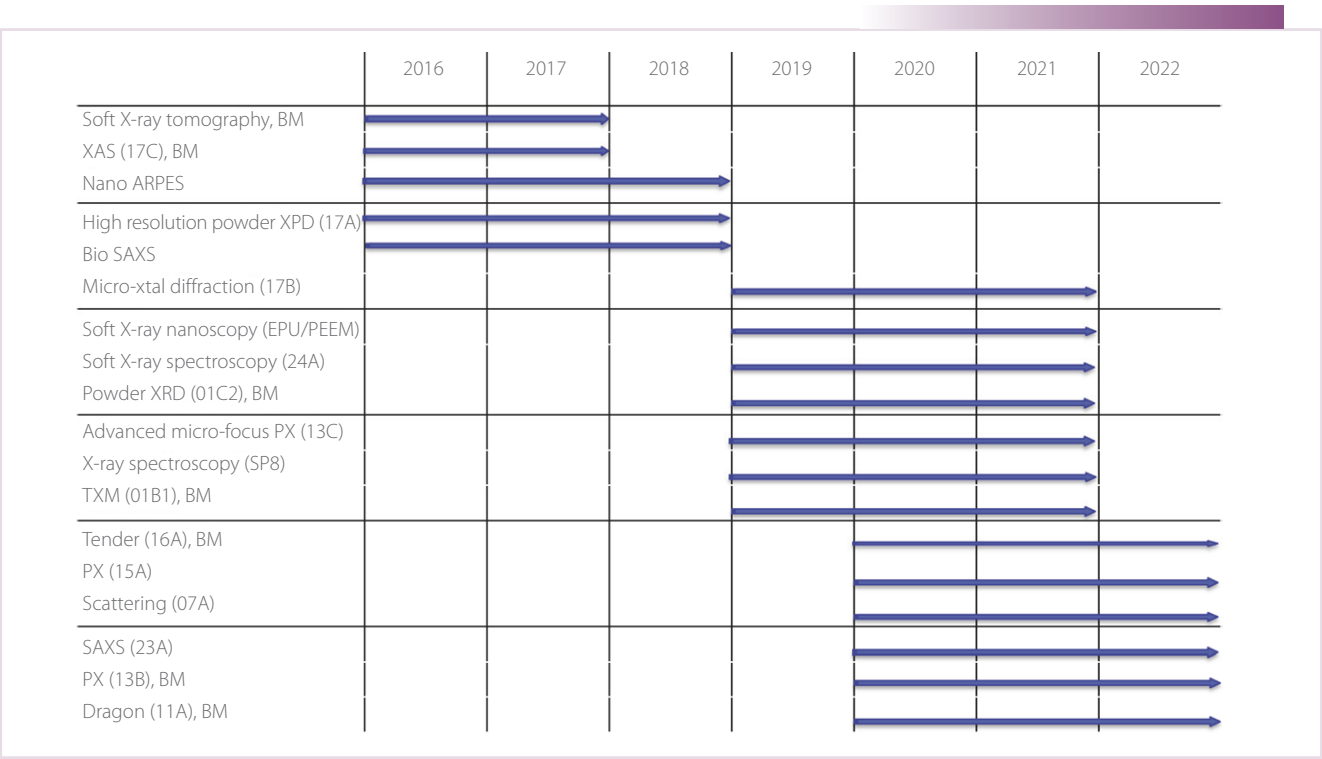


Fig. 1: Construction schedule of TPS beamlines in phase II from 2016 to 2022.

Based on these guidelines, Fig. 1 shows the construction schedule of TPS beamlines in phase II from 2016 to 2022. The first five beamlines focus on new techniques and relocated beamlines with substantial upgrade. The interruption to user beam time due to the relocation of beamlines in the last fifteen beamlines will be minimized. The floor map of TPS beamlines in phase I and phase II is presented in Fig. 2.

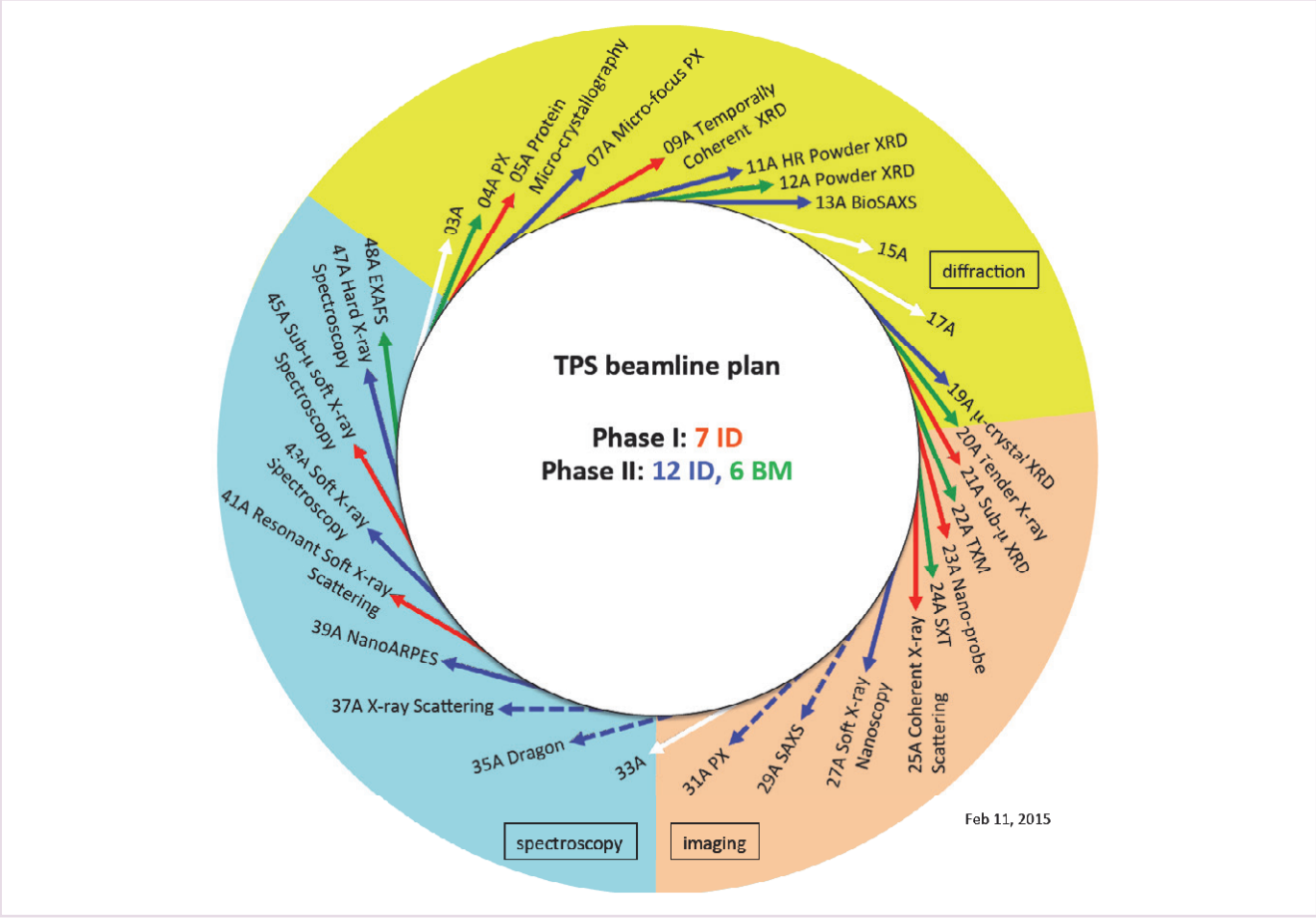


Fig. 2: Beamline map of the TPS. Beamlines in phase I are shown in red; those shown in blue and green are, respectively, insertion-device and bending-magnet (BM) beamlines in phase II.