The Plan of TPS Phase-II Beamlines

NSRRC has evolved into an internationally well-known light-source facility since Taiwan Light Source (TLS) emitted its first light and became operational in 1993. In response to increasing demands for brighter X-rays to facilitate sophisticated scientific experiments, NSRRC proposed to construct Taiwan Photon Source (TPS), a 3-GeV low-emittance synchrotron light source. After years of effort, TPS delivered its first photon beam in December, 2014, and successfully stored an electron current 520 mA in its storage ring on December 12, 2015. Now TPS has moved from the commissioning stage to the operational stage.

TPS is designed to accentuate electron beams of small emittance and great brilliance to generate extremely bright photon beams. The superior characteristics of TPS have opened avenues to innovative scientific opportunities for scientists in diverse areas of research to reveal structures, electron interactions, functions of materials and their dynamics, using various spectral and imaging methods and scattering techniques. Seven TPS phase-I beamlines include **05A** Protein Micro-crystallography, **09A** Temporally Coherent X-ray Diffraction, **21A** X-ray Nanodiffraction, **23A** X-ray Nanoprobe, **25A** Coherent X-ray Scattering, **41A** Resonant Soft X-ray Scattering and **45A** Submicron Soft X-ray Spectroscopy. Four beamlines among them, **05A**, **09A**, **21A** and **25A**, have been completed and open to general users since September, 2016.

To use fully the characteristics and to attain the potential of TPS, NSRRC has proposed a plan to construct nine phase-II beamlines. Frontier techniques, such as X-ray imaging, nanoscopy, high-resolution diffraction and high energy-resolution spectroscopy, have been identified to drive novel science at TPS. The phase-II beamlines also focus on powerful techniques for studies of biomedical imaging, green energy and nano-devices. The plan comprises six undulator beamlines and three bending magnet beamlines, which place an emphasis on new facilities for high-impact science and a smooth transition from TLS to TPS. These beamlines are listed as follows:

07A Micro-focus protein crystallography/Micro-focus PX/(13C)
13A Biological small-angle X-ray scattering/BioSAXS
15A Micro-crystal X-ray diffraction/Micro-crystal XRD/(17B)
19A High-resolution powder X-ray diffraction/HR Powder XRD/(17A)
22A Transmission X-ray microscopy/TXM/(01B)
24A Soft X-ray tomography/SXT
27A Soft X-ray nanoscopy
39A Nanometer angle-resolved photoemission spectroscopy/NanoARPES
44A Quick-scanning extended X-ray absorption fine Structure/QEXAFS/(17C)

For the beamlines transferred from TLS, their corresponding beamline numbers at TLS are indicated in parentheses.

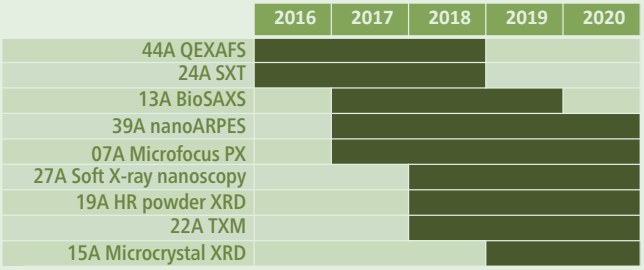

Fig. 1: Construction schedule of TPS phase-II beamlines .

The principle of beamline planning for TPS phase II strengthens the experimental techniques that are not incorporated in phase I. The strategy of relocating beamlines from TLS to TPS aims for a smooth transition that is able to retain and to continue the overall scientific output and to enhance the quality of research performed at NSRRC. Based on these guidelines, **Fig. 1** shows the construction schedule of TPS phase-II beamlines from 2016 to 2020. Phase-II beamlines have been funded and under construction since 2016. The floor map of TPS beamlines is presented in **Fig. 2**. (Reported by Yu-Shan Huang)

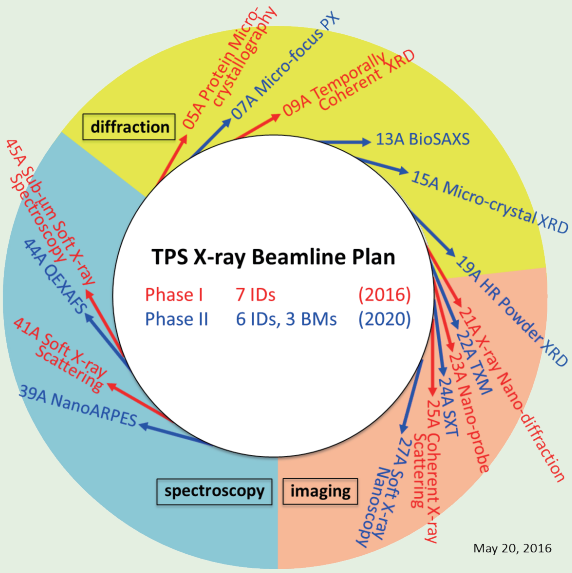

Fig. 2: TPS beamline map; phase I shown in red, phase II in blue.