Taiwan Photon Source (TPS) is a 3 GeV synchrotron light source which is being in construction at NSRRC. Design of various diagnostics are undergoing and will deploy in the future to satisfy stringent requirements of TPS for commissioning, top-up injection, and operation. These designs include beam intensity observation, trajectory and beam position measurement, destructive profile measurement, synchrotron radiation monitors, beam loss monitors, orbit and bunch-by-bunch feedbacks, filling pattern and etc. are in final design phase. Details of current status and implementation of the planned beam instrumentation system for the TPS will be summarized in this report.

Introduction

The NPCT provides a resolution of better than 1 μm, and has large dynamic range of 100 μm at RF frequency and is capable to make itself a versatile device for measuring lifetime and injection efficiency.

The storage ring filling pattern observed from the sum signal of BPM buttons by side handrails fast digitizer sampling at a multiple of RF frequency will enable measurement of the bunch current to better than 0.5% accuracy. - The X-ray BPM was chosen as baseline design at the conceptual design phase.

Storage Ring Diagnostics

- The photon diagnostics for the TPS storage ring will utilize visible and X-ray synchrotron radiation generated in a bending magnet.
- Visible light beamline will be built to measure various beam parameters by streak camera, CCD camera and interferometer.
- Synchrotron mode operate for the streak camera at 250 MHz is preferred. Integrating the streak camera system with EPICS is preferred.
- Two X-ray pinhole cameras imaging the electron beam from bending magnets is the baseline design for the emittance measurement and measure the electron beam size at all currents from < 1 mA to 400 mA.
- The X-ray photon BPMs (XPBMs) will be installed at each beamline. The slow data for control system access and the fast data for feedback purposes.
- Prototype of Libera Photon has been testing intensively at the 1.5 GeV TSL.
- Measuring the filling pattern by using time correlated single photon counting (TCSPC) is also considered. And APD detector to detect scattered X-ray photon will provide input for the TCSPC system. More than six order of dynamic range are expected.

Infrastructure for orbit measurement, control and feedback

- Orbit feedback computation will distribute to the FPBSA modules installed at the BPM platform in each cell.
- Suffer nodes will be setup to capture orbit information in 10 kHz rate for more than 10 sec and decimated data at lower rate for much longer record time for various applications and analysis.

Bunch-by-bunch feedbacks and diagnostics

- Transverse combined bunch instability mainly caused by the resistive wall impedance and other sources will determine beam quality. Two plane Bunch-by-bunch feedback system is planned to suppressed instabilities.
- Transverse feedback kickers are planned to applied the SE/SELETRA design and capable with TPS vacuum vessel. Transverse signals pick-up will be used as an extra BPM and installed at location of high beta function and beam excitation and etc.
- Features of the planned system include the latest high dynamic range ADC/DAC (12/16 bits), high performance FPGA, flexible fiber design, bunch feedback, time measurement, beam loss cleaning, various beam extraction scheme, flexible connectivity, and seamless integrated with the control system.
- On-line control interface to operate feedback system and off-line analysis tools should be included.

Summary

Beam diagnostics designs and implementation for the TPS are in proceed. Status is summarized in this report. The critical diagnostic from a diagnostic point of view and low emittance machine has been investigated in this design phase. Major procurement are scheduled in 2011–2012. Optimizing the design, prototyping and working out on specifications are currently in progress. System integration is planned in 2013. Delivering a best diagnostics system to satisfy stringent requirements of TPS is the goals.