Diamond Light Source Proceedings

http://journals.cambridge.org/DLS

Additional services for ***Diamond Light Source Proceedings:***

Email alerts: Click here
Subscriptions: Click here
Commercial reprints: Click here
Terms of use : Click here

Status of Taiwan Photon Source front end in National Synchrotron Radiation Research Center

I. C. Sheng, C. K. Kuan, Y. T. Cheng, Y. H. Yan, G. Y. Hsiung, J. R. Chen and C. L. Chen

Diamond Light Source Proceedings / Volume 1 / Issue MEDSI-6 / October 2011 / e25
DOI: 10.1017/S2044820110000341, Published online: 27 October 2010

Link to this article: http://journals.cambridge.org/abstract_S2044820110000341

How to cite this article:
I. C. Sheng, C. K. Kuan, Y. T. Cheng, Y. H. Yan, G. Y. Hsiung, J. R. Chen and C. L. Chen (2011). Status of Taiwan Photon Source front end in National Synchrotron Radiation Research Center. Diamond Light Source Proceedings, 1, e25 doi:10.1017/S2044820110000341

Request Permissions : Click here

CAMBRIDGE JOURNALS

Downloaded from http://journals.cambridge.org/DLS, IP address: 128.3.128.208 on 26 Nov 2012

Diamond Light Source Proceedings, Vol 1, e25, page 1 of 3
MEDSI-6 2010
© Diamond Light Source Ltd 2010
doi:10.1017/S2044820110000341

Poster paper

Status of Taiwan Photon Source front end in National Synchrotron Radiation Research Center

I. C. SHENG†, C. K. KUAN, Y. T. CHENG, Y. H. YAN, G. Y. HSIUNG, J. R. CHEN AND C. L. CHEN
National Synchrotron Radiation Research Centre (NSRRC), 101 Hsin-Ann Road, HsinChu, Taiwan, R.O.C.

(Received 10 June 2010; accepted 22 September 2010)

National Synchrotron Radiation Research Center (NSRRC) in Taiwan has initialized the construction of Taiwan Photon Source (TPS) synchrotron accelerator project. This 3 GeV, 500 mA beam current third-generation synchrotron accelerator will have a total of seven insertion device beam lines at day 1 after commissioning. That is, there will be one 2 × EPU48, five IU22 and one U5 undulator beamline. Corresponding front end components such as fixed masks, photon beam position monitor, photon absorber, slits and heavy metal shutter have been designed; manufacturing of these subsystems are on the way. Several prototype assemblies are completed, tested and will be reported in this paper.

1. Introductions

Taiwan Photon Source (TPS), a 3 GeV, 500 mA beam current synchrotron accelerator in National Synchrotron Radiation Research Center (NSRRC), is currently under construction. This 518 m-circumference third-generation accelerator will provide scientists and researchers seven insertion device (ID) beamlines on day 1. That is, one elliptical polarized undulator EPU48, five in-vacuum undulator IU22 and one undulator U5 will be built. Corresponding front ends will also be designed and constructed accordingly.

Since there will not be bending magnet (BM) beamlines on day 1 in TPS, we would only focus on ID front end design. Figure 1 illustrates TPS front end assembly; we have built this front end assembly in our 1/24 prototype area. The components from left to right are (1) pre-mask/pump 1, (2) photon beam position monitor (XBPM 1), (3) fixed mask1, (4) pump 2, (5) fixed mask 2, (6) pump 3, (7) photon absorber (PAB), (8) all metal valve, (9) XBPM 2, (10) pump 4, (11) slit 1, (12) slit 2, (13) fast closing valve (FCV) and (14) heavy metal shutter (HMS). There is also one more all-metal valve just outside of the shielding wall (after HMS) but is omitted in figure 1. We have built a prototype front end that we will describe in the next section.

† Email address for correspondence: shengic@nsrrc.org.tw

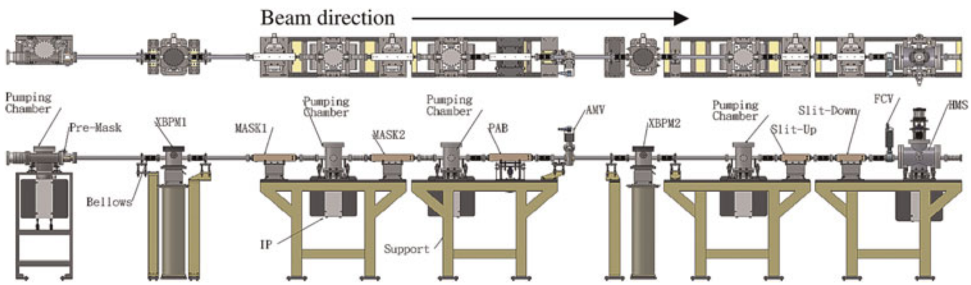

FIGURE 1. TPS ID front end assembly.

2. Design of TPS front end

Besides a ID beam, BM fan also passes through to front end; thus, pre-mask is used to trim off the BM fan outside of the ID beam to avoid any miss-steering heating to any downstream front end components. XBPM 1 is the primary photon BPM in the front end to monitor photon position; it consists of four chemical vapor deposition (CVD) diamond blades that behave as probes. Oxygen free high conductivity copper (OFHC) block with slow water flow running underneath. The XBPM are to be fabricated by advance photon source (APS) and six sets of these assemblies will be delivered by October 2010. XBPM pillars are made of steel tube containing sand and water in order to minimize ground vibration. Two x–y stages are designed to adjust the movement of the blades. Tapered rectangular aperture of fixed masks are wire EDMed, and this tapered surface is used to shape some of ID power and grazing angle to spread the beam power. One or two fixed masks in the front end depend on the power density and power size. The rule of thumb is the percentage of total power shadowed by all fixed mask(s) is 50 %, and we leave the rest 50 % to PAB, a safety absorber device to take all the synchrotron power if the interlock mechanism is activated. During normal operation, PAB is pushed up to let the beam pass through; as emergency occurs before the beam is terminated, piston pulls PAB down to block the beam. Second XBPM is installed as for redundant use only. Two slits (up and down) are the water-cooled copper blocks used to define beam size for beamline. They both have similar designs as that of fixed masks. By adjusting the position of the slits, the interception of slits' apertures confines final beam size, $4-\sigma$ are used as maximum aperture (when two slits are in coaxial position). A VAT 25CF FCV is installed prior to HMS; it is used to immediately separate (<10 ms) the vacuum system when a catastrophic failure occurs in the beamline vacuum system.

As no ratchet doors are on the outside wall of the tunnel, prior to installation one has to bring front end components by a crane from the top of tunnel, and the space on top of the tunnel might be very limited (<1 m wide and 2 m long); thus, we design supporting tables to be 0.5 m wide and 1.5 m long for easy transportation. After putting templates on the ground, we place stainless plates, bolted and levelled. These stainless plates are ensured to be flat so that supporting tables only have to be mounted on the plates without any alignment effort on the tables. Therefore, after tables are installed, the precision should be within 1–2 mm range. A precision machined surface is fabricated on the top of supporting table rail, when vacuum components are installed on the table against the datum plane, only fine tune is needed on the table top, this should dramatically reduce alignment efforts. Five ion pumps are distributed along front end. A lot of BM/ID power will strike on

FIGURE 2. One cell of TPS ID front end in the assembly area.

heat load components (pre-mask, fixed masks, PAB and slits) and lead to photon-stimulated desorption and vacuum pressure increase. More studies can be seen in Sheng *et al.* (2009). Further investigations are on the way to enhance TPS front end vacuum pressure.

An interlock system has been studied and designed; it basically follows logics in TLS. Each computer integrated area (CIA) will cover one 1/24 section in TPS. Touch panel computer will be used as interlock console to provision the system. Instead of programmable logic controller (PLC), Programmable Automation Controller (PAC) will be utilized since it is more robust, reliable and scalable than that of PLCs.

3. Installation

TPS front end team has fabricated and installed first ID front end in our one cell (1/24 section) assembly area. As shown in figure 2, besides the interlock system, vacuum components and supports have been implemented. Alignment and installation procedures also have been developed.

4. Conclusions

A typical TPS front end has been designed and constructed in the assembly area. Based on the first front end assembly experience, further mechanical/alignment improvements will be carried out to enhance new TPS front end subsystems.

REFERENCE

SHENG, I.C., CHEN, Y.T., YANG, J.Y., KUAN, C.K., HSIUNG, G.Y. & CHEN, J.R. 2009 A numerical algorithm to calculate TPS front end pressure distribution due to photon stimulated desorption induced by synchrotron radiation, presented in *The 10th International Conference on Synchrotron Radiation Instrumentation*, Melbourne, Australia, 27 September—2 October 2009.