Front Ends

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1. Introduction

At the end of March 1997, the installation of the front ends for seven beamlines has been completed, and ten more front ends are under construction. Prior to these installations, the SPring-8 project team had constructed a pilot front end in the experimental hall in order to examine the alignment method as well as the performance of its vacuum pumping system and components .

2. Pilot Front End

The construction of the pilot front end started in October 1995, and its research programs were completed in October 1996. Through these research programs, we have verified that the alignment method works well and that the final vacuum pressure of better than 3 x 10-8 Pa can be achieved along the border of the storage ring.

In the SPring-8's front ends, all components except the x-ray beam position
monitors (XBPMs) are mounted on a common base consisting of two parallel I-beams and supports. Both parallel I-beams and their components have the datum planes for vertical and horizontal directions. The common base is first aligned to a beamline before its components are fitted to it by means of the datum planes.

Figure 1 shows the alignment errors in the flange center of the components, together with those in the common base datum planes. The alignment is carried out with an accuracy of 0.25mm in both vertical and horizontal directions. This demonstrates that the alignment method works well.

We also measured the water flow induced vibrations in XBPM, and found that the vibration amplitudes were less than10nm.

3. Present Status of the Front End Construction

(1) BL09XU, 41XU, 45XU, 47XU

Installation of the standard undulator beamline front ends has been completed, and a vacuum of better than 3~4x10-8 Pa has been achieved in 4 undulator beamlines. In these beamlines, a fixed mask and a heat absorber with flat cooling water channels have been installed. An XBPM with 4 tungsten blades is placed in the upstream position. The blades will be replaced by the CVD-diamond blades. A pair of pre-slits and XY-slits have been installed. The XY-slits have the L-shaped edges with copper-mesh filled cooling water tubes, for which the water pressure drop and the flow rate are constantly monitored during the beamline operation.

(2) BL01B1, 02B1, 04B1

Installation of the standard bending magnet (BM) beamline front ends has been completed in 3 BM beamlines, and a vacuum of better than 3~4x10-8 Pa has been achieved. An XBPM with the double triangular tungsten blades are placed in the front ends.

(3) BL10XU, 39XU, 08W, 23SU, 25SU, 14B1, 38B1

The alignment of the common bases and the installation of some components has been completed. The high heat load components for the insertion device beamline (BL10XU, 39XU, 08W, 23SU, 25SU) are being manufactured. In total 6 front ends will be completed by August 1997. These are for two undulator beamlines (10XU, 39XU), an elliptic multi-pole wiggler beamline (08W), two softx-ray undulator beamlines (23SU, 25SU) and for a bending magnet beamline (14B1).

In collaboration with the APS, 4 sets of a fixed mask and a heat absorber with copper-mesh filled cooling water tubes are now being developed. Two of them will be installed in BL10XU and 39XU.

(4) BL11XU, 46XU, 27SU

The installation of the common bases has already started. The components for these beamlines are now being manufactured. Another 2 sets of the mask and the heat absorber, which are being manufactured in collaboration with the APS, will be placed in the standard undulator beamlines, BL11XU and 46XU.

4. R&D programs in 1997

(1) Research for Effective Configuration of Water Cooling Tube:

Enhancement of the heat transfer through the water cooled boundary by the water circulating tubes is essential to the design of very high heat load components. It is also important to design more compact components and to reduce the total water flow. To meet these requirements, the SPring-8 project team has initiated this particular R&D program.

(2) Performance Test of the Photo-Conductive CVD-Diamond XBPM under High Heat Load:

It has been confirmed that the prototype CVD-diamond XBPM works well in the photo conductive mode under a moderate heat load[1]. In order to examine its performance under the higher heat load, an improved CVD-diamond XBPM will be installed in the standard undulator beamline, BL47XU.

(3) Characterizing Graphite-Copper Joint:

We adopted a volumetric heating method in the pre-slits, which is installed in the standard undulator beamline front ends. In this structure, an isotropic graphite block as a synchrotron radiation receiver is joined to a water cooled copper block. Four pre-slits are joined by a brazing method and the other four pre-slits by the diffusion bonding method. We will conduct further research on the characterization of these joint gaps so that stronger graphite-copper joints can be achieved.

Reference

[1] H.Sakae, H.Aoyagi, M.Oura, H.Kimura, T.Ohata, H.Shiwaku, S.Yamamoto, H.Sugiyama, K.Tanabe, K.Kobashi and H.Kitamura; Journal of Synchrotron Radiation, to be published.

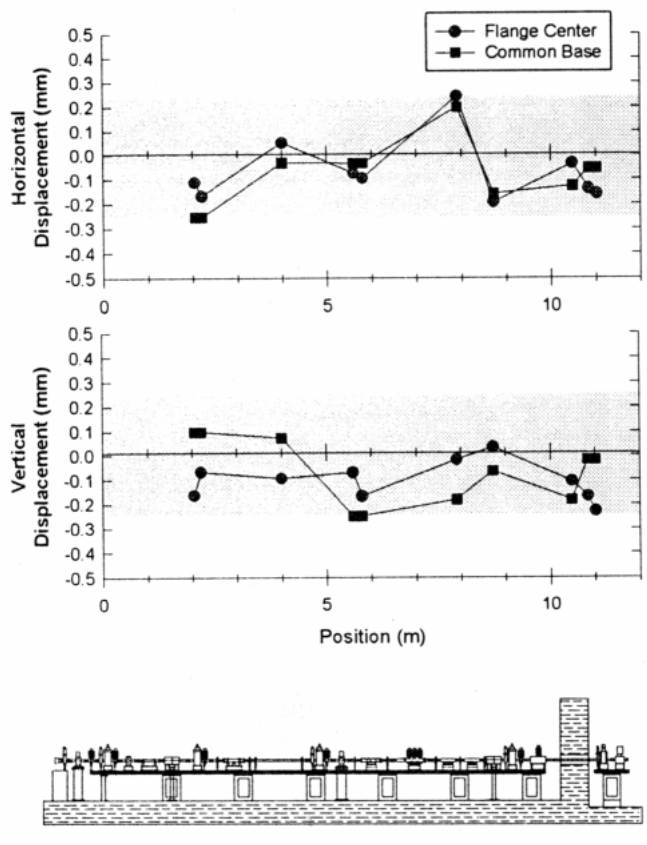

Fig 1. Alignment errors of the flange center of the components, and the datum planes on the common base.