Front Ends

Yoshiharu SAKURAI
Hideo KITAMURA

1. Introduction

At the end of March 1995, SPring-8 ordered 10 front ends except the fixed mask, heat absorber, pre-slits, variable XY slits and X-ray beam position monitor (XBPM). The fixed mask, heat absorber, pre-slits and variable XY slits will be ordered until the end of 1995. On the XBPM, SPring-8 are developing area type and wire type monitors.

The front ends will be installed in the middle of 1996. Prior to the installation, we will construct a pilot front end for an undulator beamline to test the function and the performance.

2. Front End Design Concepts

The front end design was made on the concepts of

(1) standardizing approach,
(2) common base and
(3) separated pumping unit.

Applying the standardizing approach to components and arrangements, three kinds of the front ends are developed for the undulator, multipole wiggler and bending magnet beamlines. Figure 1 shows the schematic layout of the undulator beamline front end.

All the components except the XBPMs are mounted on the common base, that is two parallel I beams with datum planes held on the supports. The common base is aligned beforehand, then the front end components are fitted on the common base using the datum planes. The XBPMs are separately supported by the base made of a low thermal expansion material. The pumping units are separated from the components to work in a differential pumping system. The ideas of the common base and separated pumping unit simplify the alignment and rearrangement of the front end components.

3. Key Components

(1) Fixed mask

The fixed mask properly confines the synchrotron radiation (SR) and prevent the SR from hitting the unprotected parts by the beam steering error. When the accident happens, it must be capable of handling the heat power. A model with the finned-structure coolant surface was examined by means of a finite element analysis. The results are reported by Nakamura and Amamoto [1].

(2) Heat absorber

The heat absorber is used to intercept the SR to protect the front-end components placed in the downstream. The basic design and operational principle are described in the previous paper [2]. The heat load on the heat

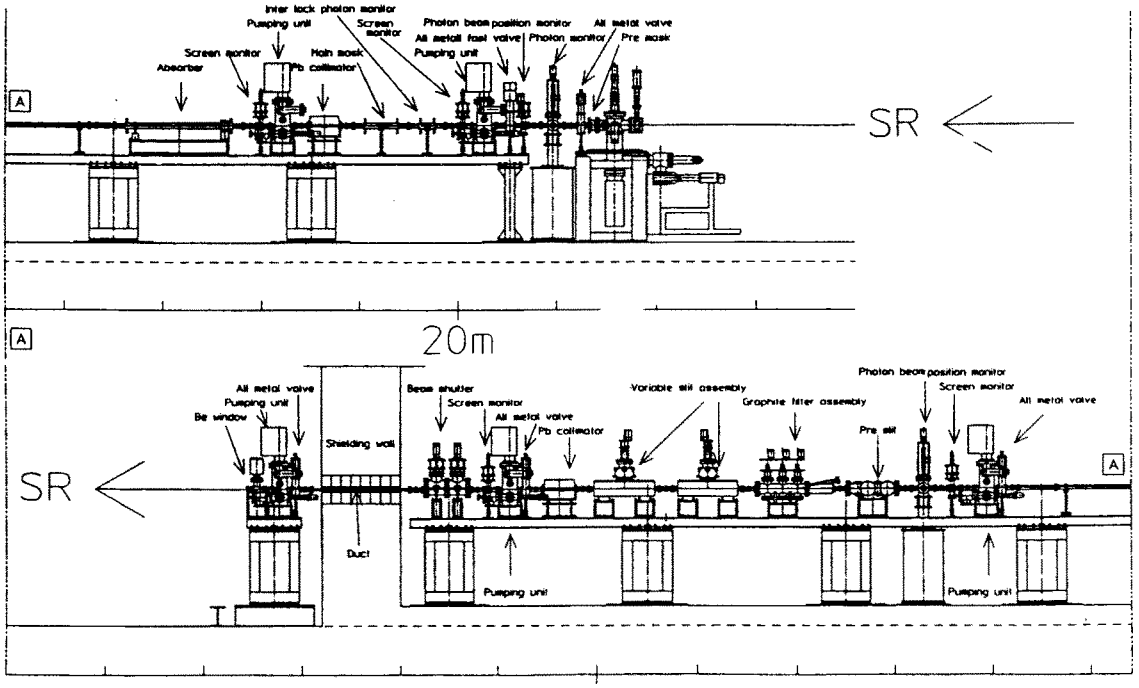

Fig. 1

absorber is same to that of the fixed mask.

Then, the finned structure coolant surface is a solution for cooling the heat absorber. For higher heat load beamlines, we are developing a pin-post cell structure as an advanced coolant surface.

(3) Graphite filters

The graphite filters are used to cut the low energy part of the SR so that the heat loads on Be windows and optics are reduced. The assembly has triple movable filters. The total thickness of the graphite can be varied with the situation. The graphite foils are cooled by the thermal conduction as well as radiation, thus the high quality and high oriented graphite foil with good thermal conductivity in the a-b plane is used as filter material.

(4) Variable slits

As shown in Fig. 2, the distribution of emitted power is quite larger than that of the first-harmonics radiation of the undulator. The variable slits are utilized to cut the unwanted part of the SR so as to reduce the heat load on the downstream components. The water-cooled L-edge shaped slits made of Gridcop or TZM are being developed in collaboration with APS. The details are reported by Oura et al [3].

(5) Be windows

Dual Be windows are put at the end of the front ends to separate the storage ring vacuum and the optics vacuum in hard X-ray beamlines. CVD diamonds are alternative to Be as advanced material for windows. Thermal analyses on Be and diamond windows are reported by Sakae et al [4].

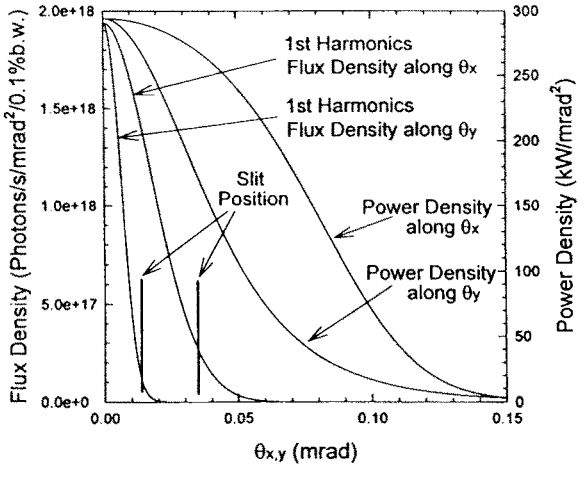

Fig.2

(6) XBPM

SPring-8 is developing the area type and the wire type XBPMs. The later is reported by Shiwaku et al. [5]. The former is made of a CVD diamond or graphite foil. The CVD diamond XBPM detects the current of electron and hole careers produced in the diamond bulk by X-rays.

(7) Pumping unit

The pumping unit consists of an ion pump, two Ti sublimation pumps, Viton and metal valves and a BA gauge. The SR go through the body of the ion pump.

4. Program plan for 1995

(1) Pilot front end

A whole of the front end for an undulator beamline is constructed to examine the performance of the alignment, the vacuum and the utilities, and test the function of the components and the front end control system.

(2) Performance test of the slits and the XBPM at KEK.

The performance of the L-edge shaped variable slits and the CVD diamond XBPM are tested at the Tristan MR at KEK, in collaboration with KEK.

(3) Heat load test by electron beam irradiation

The cooling performances of the Be windows and the graphite and metal filters are tested by electron beam irradiation. The optimization of cooling channel for the mask, absorber and slit blades are also carried out.

References

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[3] M. Oura, H. Kitamura, D. Shu and T.M. Kuzay, in this report

[4] H. Sakae, Y. Sakurai and H. Kitamura, in this report

[5] H. Shiwaku, H. Sakae and H. Kitamura, in this report