BEAM DIAGNOSTICS BEAMLINE AT HISOR

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Abstract

Beam diagnostics beamline has been constructed at HiSOR BL8 and just started to operation. The main aim of the beamline is to measure the characteristics of circulating electron beam and radiated synchrotron light using a self-tracking wire monitor, a CCD camera and a streak camera. In this paper, we report the outline of the beamline and show preliminary results of measurements.

1 INTRODUCTION

HiSOR is an electron storage ring dedicated to the synchrotron radiation experiments. HiSOR is a racetrack type ring. It consists of two 180° bending sections and two straight sections installed by undulators. There are total of 16 beam ports, in which 14 ports are for synchrotron radiation light from the bending section and 2 ports are for undulation light from the straight sections. Main parameters of HiSOR, at the storage energy of 700 MeV, are shown in table 1. More details of the HiSOR is reviewed in [1].

In order to achieve the stable operation of the synchrotron light source, it is indispensable to monitor the behavior of the radiated light and circulating electron beam. For this purpose, beam diagnostics beamline BL8 has been constructed at one of the beam port located on the bending section.

Table 1: Main parameters of HiSOR

Energy	700 MeV (Storage)
Circumference	21.946 m
Bending Radius	0.87 m
RF frequency	191.244 MHz
Harmonics	14
Beam Size at Straight Section	1.510 mm (Horizontal) 0.089 mm(Vertical)
Beam Divergence at Straight Section	0.408 mrad(Horizontal) 0.045 mrad(Vertical)
Natural Bunch Length	115 ps

2 OUTLINE OF THE BEAMLINE

Schematic side view of the beamline is shown in Figure 1. Main components are a self-tracking wire monitor and reflecting mirrors which are located at 3.15m and 6.76m from radiation point, respectively. The position of the synchrotron radiation light is measured by the self-tracking wire monitor. Although only one wire monitor is installed at present, we have a plan to install second monitor in the near future. Thus the measurement of the radiation angle of the synchrotron radiation light will become possible.

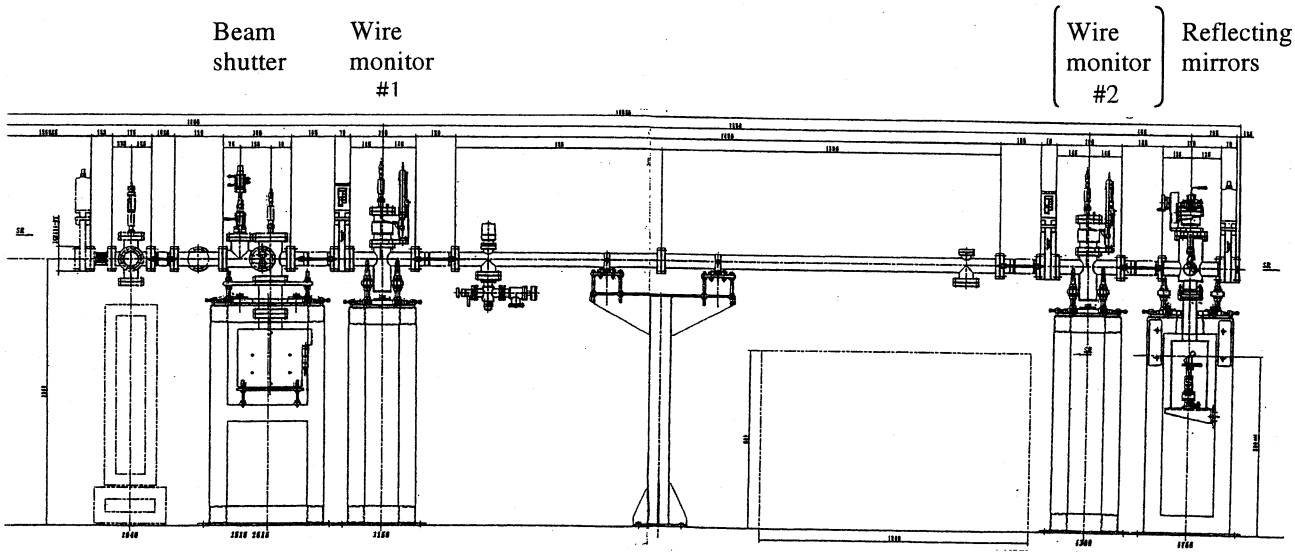

Figure 1: Schematic side view of the beamline

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The synchrotron radiation light is reflected by the reflecting mirrors and lead to the optical table. A CCD camera and a streak camera are placed on it for the measurement of the profile and the time structure of the electron beam, respectively. A distance from the radiation point to the CCD camera and streak camera is about 10m.

Self-tracking wire monitor was designed based on the beam monitor constructed by Miyahara and Mitsuhashi[2]. Photocurrents are measured through two wires mounted on a flange. The flange can be moved by a pulse-motor and controlled by feedback electronics so that the ratio of the two photocurrents becomes constant. The position of the beam is measured by a digital gauge which detects the position of the flange. The merit of the self-tracking system is that the linearity of measurement can be improved since amount of radiation is almost same for both wires. The profile of the beam can be also measured by scanning the wires.

3 MEASUREMENTS

We did the first measurement to check the performance of the beamline. The preliminary results of measurements are shown below. The results show the performance of the beamline is good as expected.

3.1 Profile and Position of the Synchrotron Radiation Light

The vertical profile and position of the synchrotron radiation light, at the position of 3.15m from the radiation point, are measured by the self-tracking wire monitor. Figure 2 shows the vertical profile of the beam. It shows gaussian distribution. A half-width of the synchrotron radiation is about 2.3mm at this point. Figure 3 shows the variation of the beam position during one-day operation. It was observed that the position of the synchrotron radiation drift around 100 μ m.

Absolute value of the beam position can be measured with a precision of about 100 μ m, it is limited by the precision of the alignment. The precision of relative value of the beam position is roughly estimated to be within 10 μ m. At moment it is limited by the lack of adjustment of the parameters such as wire gain, distance between wires and so on. With better adjustment of the parameters, the precision of the measurement will become much better. We are now proceeding the adjustment.

3.2 Profile of the Electron Beam

Figure 4 shows the transverse profile of the electron beam observed by using a CCD camera, TELI CS8530-01.

3.3 Time Structure of the Electron Beam

Figure 5 shows the time structure (bunch length) of the electron beam or the synchrotron radiation light, observed by using a streak camera, HAMAMATSU C1370-01. Bunch length is 110～120ps at 700 MeV operation.

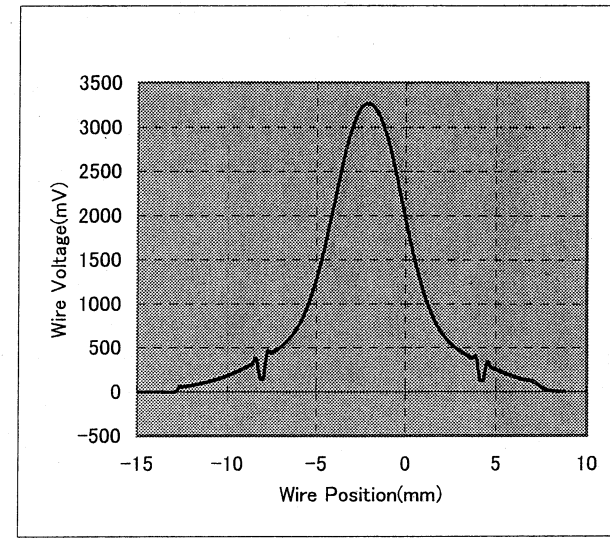

Figure 2: Vertical profile of the synchrotron radiation light

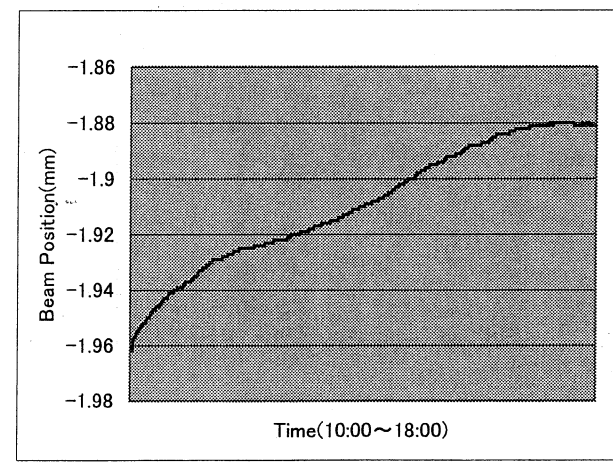

Figure 3: Position of the synchrotron radiation light

Figure 4: Transverse profile of the electron beam

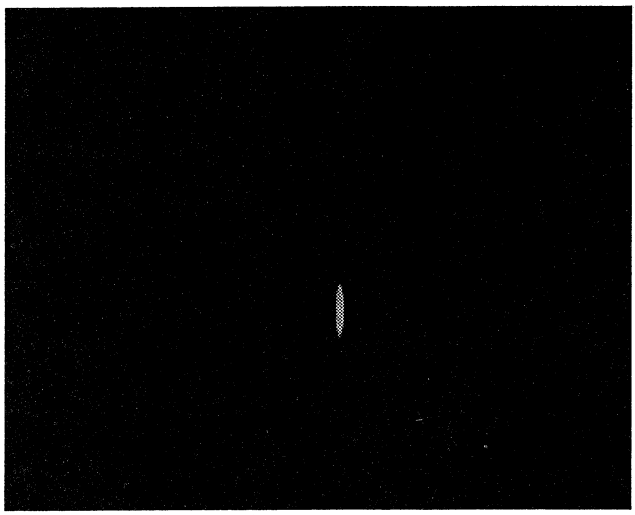

Figure 5: Time structure of the electron beam

4 SUMMARY

Dedicated beam diagnostics beamline has been constructed at HiSOR in order to measure several characteristics of the electron beam and the synchrotron radiation light. Operation has just started. First results of the several measurements are shown. It shows that the performance of the beamline is good as expected.

5 REFERENCES

[1] K.Yoshida et al., J. Synchrotron Rad.(1998)345
[2] T.Miyahara et al., Rev. Sci. Instrum.63(1992)538