A PC-BASED UNDULATOR CONTROL SYSTEM FOR HiSOR

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1 INTRODUCTION

The synchrotron radiation source at Hiroshima University (HiSOR) [1] consists of the AURORA-2D [2] (a storage ring and a racetrack microtron), a linear undulator and a helical undulator. Fig.1 shows a layout of HiSOR storage ring. Gap and phase of the helical undulator change the characteristic of output light. Fig.2 shows a schematic of the helical undulator [3]. The gap is a distance between upper and lower jaws, and the phase is a shift value of the 4 side magnet arrays. There are 8 steering magnets for COD compensation. Compensation values are changed by the operation mode of the helical undulator. However these compensation values are determined after actual operation at every operating points. We install a program to calculate approximate compensation values by using known operating data and interpolation in HiSOR control system. In this paper, the schematic of this control system and the compensation method are described.

2 CONTROL SYSTEM

Fig.3 shows the HiSOR control system [4]. The control system consists of a fileserver, two PCs for device control and two PCs for man-machine system [5]. One of man-machine PC can receive a command for helical undulator control via RS-232C. Received command is converted and sent to the device control PCs to change the gap, the phase or the current of steering magnets by the method written in next section. External PC or touch panel, which are installed in the experimental hall, are connected to the control PCs with RS-232C line.

3 COMPENSATION METHOD

The following COD compensation algorithm is installed in this system.

(1) When one operating mode is selected, a compensation value table to be use is selected. Table 1 shows structure of the table for all compensation devices. Operating points (entry) and compensation values are written on a row.

(2) The entry of the table is defined by following formula.

$$entry = Phase + 3600 \times Gap$$

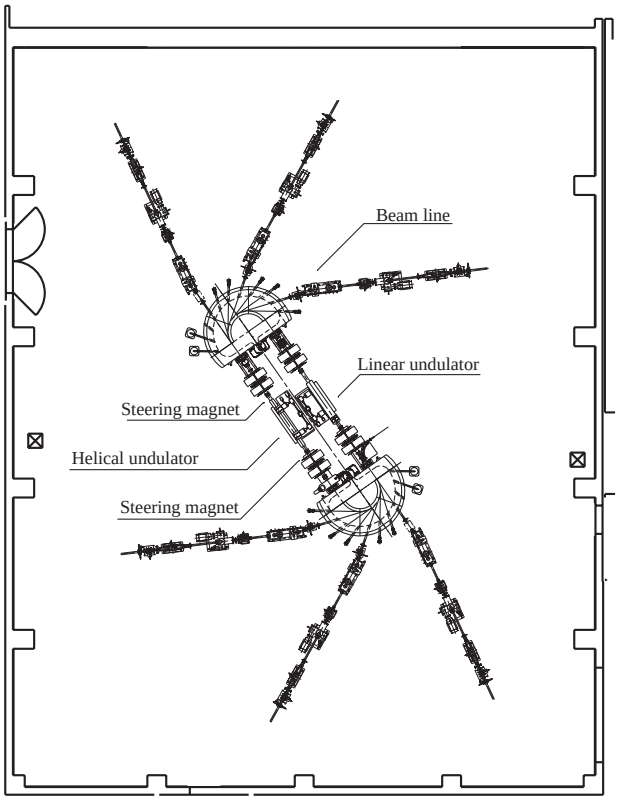

Figure 1: Layout of HiSOR storage ring.

(3) If this table has the entry, COD compensation value is obtained from this table.

(4) If there is not the entry on this table, an approximate value of COD compensation value is obtained by interpolation. If there are too few data in the table, default values (or 0) are used to compensate.

After fine adjustment, new entry is created and current values are written on this table as the optimum.

By this method, it is not necessary to write the exact value of COD compensation, before installation. By repeating the operation of the helical undulator, this table will be grown up, and it is expected to obtain more-precise value. Fig.4 shows the result of COD compensation at the 60-mm gap. Vertical scale of the figure is deviation from 200-mm gap orbit. In this figure, a broken line shows before COD compensation and solid line shows COD after compensation.

4 CONCLUSION

Remote control functionality of the helical undulator and estimation program of COD compensation value are installed in HiSOR control system. The estimation program uses a table, and its entry will grow up by experiment. As the table growing, it is expected that estimation values become more accurate.

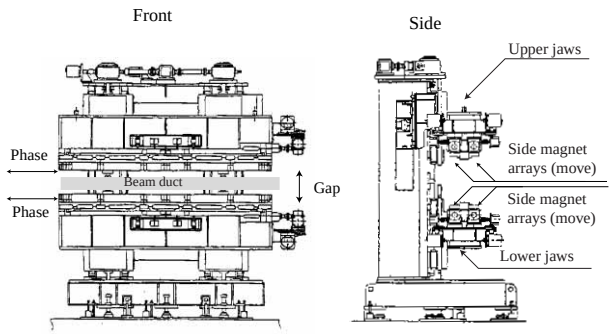

Figure 2: The HiSOR helical undulator.

REFERENCES

[1] K.Yoshida et al.: “Commissioning of a Compact Synchrotron Radiation Source at Hiroshima University”, APAC’98 (1998: KEK, Tsukuba, Japan)

[2] T.Hori and T.Takayama: ICSRC-AFSR’95 (Oct. 25-27, 1995: Kyongju, Korea) p.148-158

[3] A.Hiraya, K.Yoshida, S.Yagi, M.Taniguchi, S.Kimura, H.Hama, T.Takayama and D.Amano: “Undulators at HiSOR-compact racetrack type ring”, SRI’97 (1997: Himeji, Japan)

[4] K.Aoki, K.Kawamura and K.Yoshida: “Control System for HiSOR”, IWCSMSA’96 (1996: KEK, Tsukuba, Japan)
K.Aoki, K.Kawamura, D.amano and K.Yoshida: “A PC-based Control System for HiSOR”, ICALEPCS’97 (1997: Beijing, China)

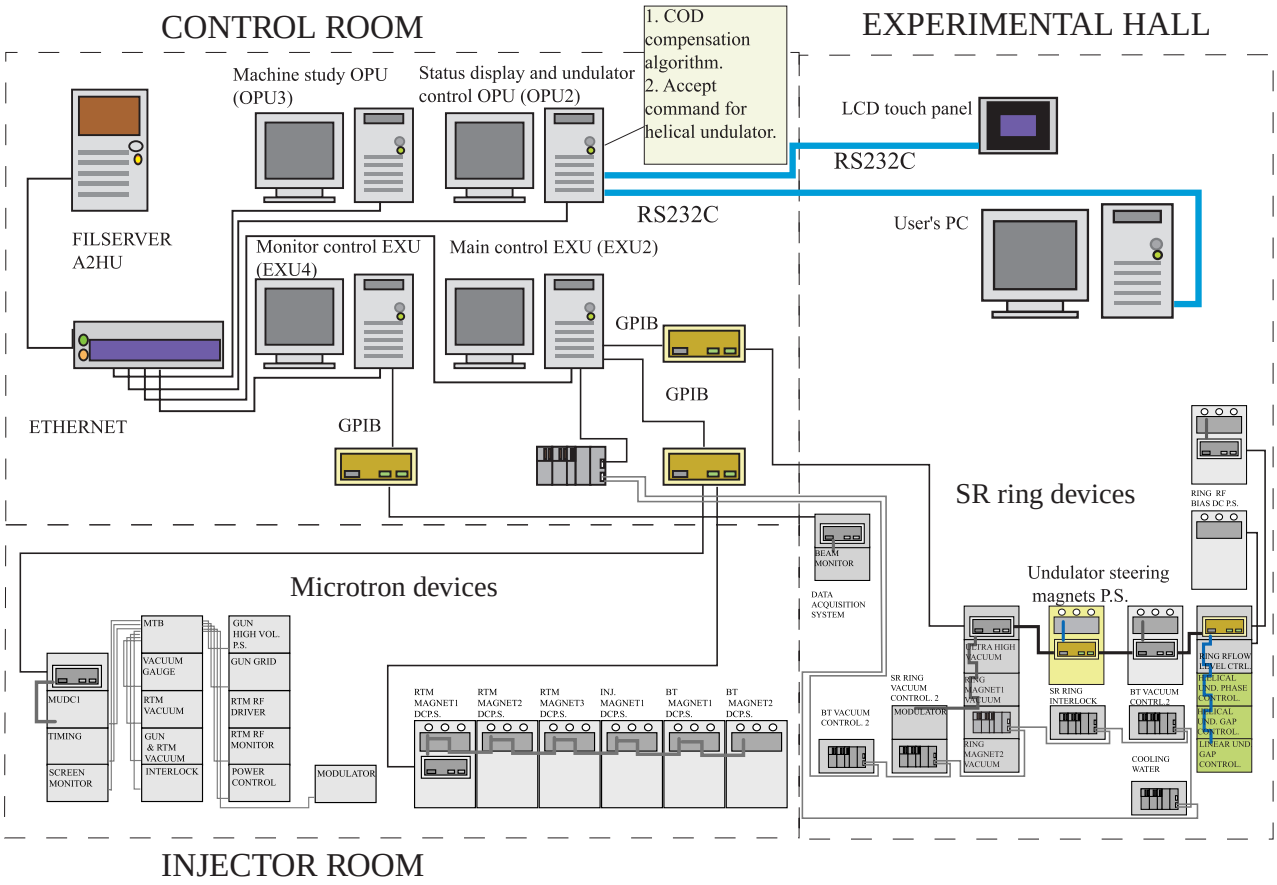

Figure 3: HiSOR control system.

Table 1: Structure of COD compensation table.

GAP [mm]	PHASE [deg.]	Entry	STH1 [A]	STH2 [A]	STH3 [A]	STH4 [A]	STV1 [A]	STV2 [A]	STV3 [A]	STV4 [A]
30.0	1	108001	4.6	4.6	4.6	5.6	5.6	5.6	6.6	7.6
	:	:	:	:	:	:	:	:	:	:
	360	108360	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
30.1	1	108361	3.5	3.5	3.5	4.5	4.5	4.5	5.5	6.5
	:	:	:	:	:	:	:	:	:	:
	360	108720	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
35.5	1	127801	:	:	:	:	:	:	:	:
	:	:	*1.62*	*1.62*	*1.62*	*1.62*	*1.62*	*1.62*	*1.62*	*1.62*
	200	*128000*	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:
	360	128160	:	:	:	:	:	:	:	:
35.6	1	128161	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
	:	:	:	:	:	:	:	:	:	:
	360	128520	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55
:	:	:	:	:	:	:	:	:	:	:
36.0	1	129601	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	:	:	:	:	:	:	:	:	:	:
	360	129960	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
:	:	:	:	:	:	:	:	:	:	:
198	1	712801	-3.6	-3.6	-3.6	-3.6	-3.6	-3.6	-3.6	-3.6
	:	:	:	:	:	:	:	:	:	:
	360	713160	-3.8	-3.8	-3.8	-3.8	-3.8	-3.8	-3.8	-3.8
199	1	716401	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0	-4.0
	:	:	:	:	:	:	:	:	:	:
	360	716760	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2
200	1	720001	-4.3	-4.3	-4.3	-4.3	-4.3	-4.3	-4.3	-4.3
	:	:	:	:	:	:	:	:	:	:
	360	720360	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6

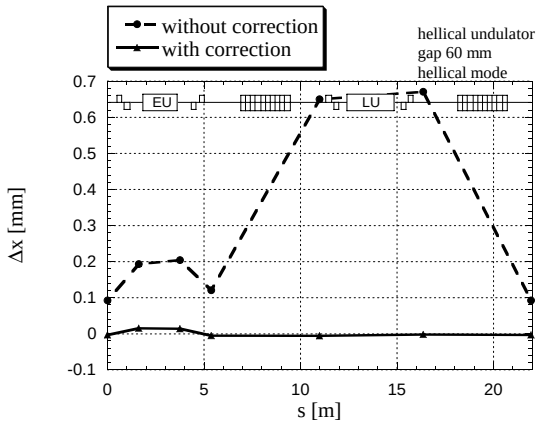

Figure 4: Result of COD compensation at the 60-mm gap.