SPring-8 Insertion Device Control System

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1. Introduction

At SPring-8, insertion device (ID) is considered to be a part of a beamline instead of that of the storage ring. Consequently, the control system for IDs is under beamline control system which handle the control of IDs, front-ends (FE) and transport channels including the optics. ID control system at SPring-8 is markedly different from that either at ESRF or at APS due to various reasons. We explain the outline of the system in the following.

2. Main Concept and Hardware Components

Unlike ESRF or APS where there are a few software engineers exclusively for ID control, there is no such staff at SPring-8 at present time. As a consequence, minimization of software dependence has to be a key concept for SPring-8 ID control system. In addition, there is a request from the manufacture of the mechanical parts of the device to make gap related controls such as motor, encoder, limit switch (LS), etc. be operational without a PC or use of keyboard. Therefore, we decided to have a company (Tsuji Denshi, Inc.) make a gap controller unit (GPC series) which includes stepping motor controller, encoder reader and LS input with GPIB interface. With this unit, ID gap can be opened manually in case a VME unit malfunctions.

Interlock is essentially eliminated with the exception of gap-full-open flag which goes to a front-end programmable logic controller (PLC) from a separate LS and it is independent of ID control.

There is another parameter to be monitored, which is unique for in-vacuum devices, is temperature of magnet array and transition area which is defined to be the area between a ring vacuum chamber and the ID. A standard SPring-8 in-vacuum ID has 32 points to monitor the temperature. Stand-alone data acquisition unit (YOKOGAWA DA100) has been chosen instead of a number of VME boards to reduce cost per channel for the time being. This unit can handle not only thermocouple input but also analog voltage and digital input (DI) and was used to monitor ion pump HV status and vacuum gauge till VME-DI board (Advanet Advme1208) and 16 bit VME-ADC board (Advanet Advme2601) become available. This ADC board could handle not only voltage signal from beam position monitors (BPM) (Bergoz) but also thermocouple outputs. Eventually, DA100 should be replaced by these VME boards to reduce the load on the GPIB board. A simple current power supply with GPIB (HP-6621A) is also temporarily employed for the long coils which go around the vacuum chamber.

3. Equipment Manager (EM) and VOC Table

The details of EM are found elsewhere [1]. The EMs for GPIB based equipment are written in separate program so as to make future upgrade to VME based unit easier. Table 1 shows VOC commands for a standard in-vacuum type undulator (BL47.) Note that um is used for µm.

Table 1. VOC table (ID-EM Version 1.0) for a standard in-vacuum ID (BL-47.)

O	Command C	Return C	Function
V = bl_id47_gap			
put	%fmm	OK / fail	Gap change
put	open	OK / fail	Full open
put	stop	OK / fail	Regular stop
put	emstop	OK / fail	Emergency stop
get	gap	%fmm / fail	Present gap value
get	status	%02X / fail	LS status
V = bl_id47_st_n_x			
put	%fA	OK / fail	ST mag current
get	prcurrent	%fA	Present surrent
get	status	%d / fail	PS status
V = bl_id47_mag_n			
put	setup	OK / fail	DA100 setup
get	temperature	%fC / fail	Magenet temp.
V = bl_id47_trans_n			
put	setup	OK / fail	DA100 setup
get	temperature	%fC / fail	Transition temp.
V = bl_id47_ivg_n			
put	setup	OK / fail	DA100 setup
get	pressure	%fPa / fail	Magenet temp.
V = bl_id47_sip_n			
put	setup	OK / fail	DA100 setup
get	status	OK / fail	SIP HV status
V = bl_id47_rfbpm_n_x			
get	position	%fum / fail	BPM reading

4. Gap-ST Mag. Synchronization and Other Issues

There are a few other issues to be discussed regarding EM. The first one is how to synchronize steering magnet current with ID gap change through a table. The second is how to automate ID commissioning process.

We propose defining one object (ex. bl_id47_idparm) to a corresponding table. For this table, there is an array (ex. idparm[n][2]) to be read and written. The size of this array depends on the table. As there is only one set of steering magnets is used for a standard ID, there are two columns in above example but the number of column could be different depending on the configuration of the devices. "Put" would write the data taken from whatever devices to the table and "get" would retrieve them from it. This table should be stored in a file by standard UNIX I/O. This scheme with some modification will be incorporated in the coming version of EM.

This table will be rewritten at numerous times during ID commissioning. It is not yet certain how to automate this process of rewriting steering magnet table from the COD data.

A commercial relational database (DB) (SYBASE SQL Server 10) manages a parameter DB, a on-line DB and an archive DB. The following are a list of parameters stored to the DB through a poller-collector: gap /phase, steering magnet current, ivg reading, magnet / transition temperature and BPM reading. It might be necessary to have another GPIB board take up temperature data but at this stage it has yet to be determined whether to add it or not.

5. Graphical User Interface (GUI)

Like other beamline components, Xmate is used to construct GUIs for SPring-8 IDs. It is based on the Motif 1.2 and X11 protocol. There will be two types of GUIs; elaborate ones for commissioning purpose and simpler, easy-to-read ones for user use. Figure 1 shows a preliminary version of ID-GUI.

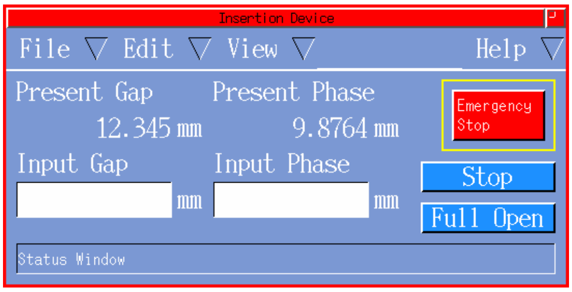

Fig. 1. Preliminary version of ID-GUI (as of March 31, 1997)

6. Conclusion

SPring-8 ID control system has been constructed under limited software resources and budget. Future upgrade is inevitable in order to improve system reliability and speed. Reducing the number of equipment on a GPIB board is planned in the near future.

References

[1] A. Taketani et al., "Equipment Manager of the VME Control System for the SPring-8 Storage Ring," Proc. Int. Conf. on Accelerator and Large Experimental Physics Control System, Chicago, Oct. 30 - Nov.3 (1995)