NOVEL PERSONNEL SAFETY SYSTEM FOR HLS-II

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ABSTRACT

The novel HLS-II PSS is used to keep radiation damage away from staffs and users which is designed based on Siemens redundant PLC under EPICS. The novel PSS consists 3 parts: the safety interlock system defines the interlock logic, the access control system can restrict the access of HLS-II secruity doors and provide the personnel management function, the radiation control system is used to monitor the radiation dose rate in the light source and the surrounding areas. The offline test results show the new system reaches the design goals.

SYSTEM ARCHITECTURE

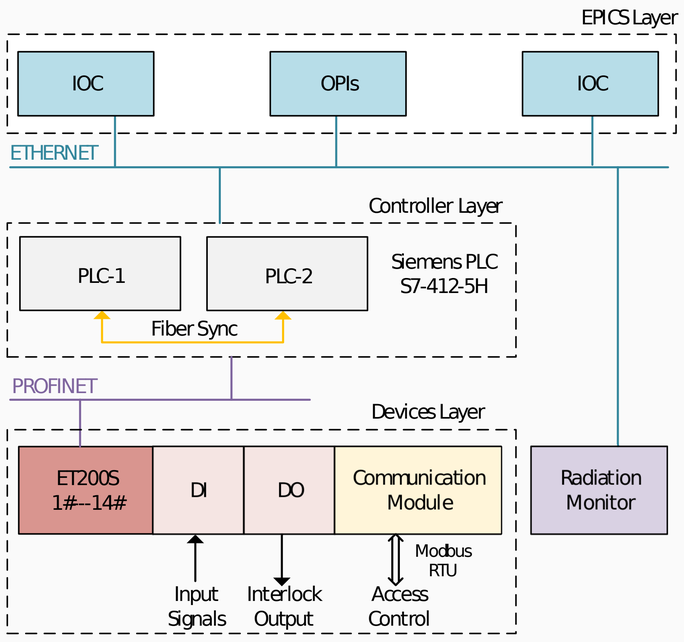


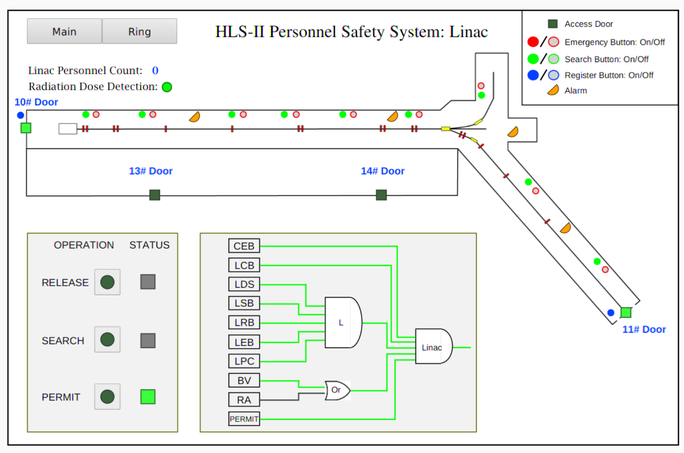
Fig. 1: Architecture of the Hardware Interlock System

Novel PSS has 3 Layers as it's shown in Fig.1: the EPICS layer, Controller layer and the Devices layer.

1. *EPICS layer:* It contains EPICS IOCs and OPIs.
2. *Controller layer:* It has a pair of Siemens redundant PLC. The master PLC and the slave PLC synchronize data via fiber.
3. *Device layer:* It has 14 Siemens IO stations to control 14 security doors.

OPIs FOR HLS-II PSS

Fig.2 and Fig.3 are 2 OPIs for new HLS-II PSS used to demostrate the linac area and storage ring area seperately.
Each OPIs can be divided into 4 parts: 1) the status of security doors; 2) the personnel count and the radiation dose monitor state; 3) the real-time interlock logic diagram; 4) the operation commands.



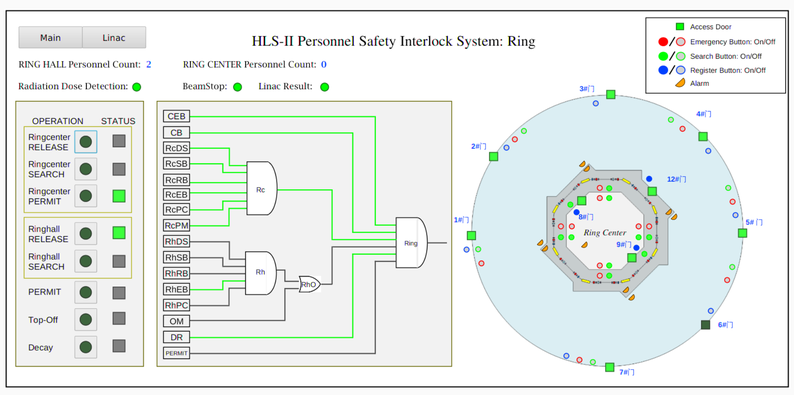


Fig. 3: The OPI of Linac (up) and the OPI of Storage Ring (down)

DESIGN OF SAFETY INTERLOCK SYSTEM

The safety interlock system is the crucial subsystem to process the interlock logic. Fig.4 shows the workflow chart of the safety interlock system.

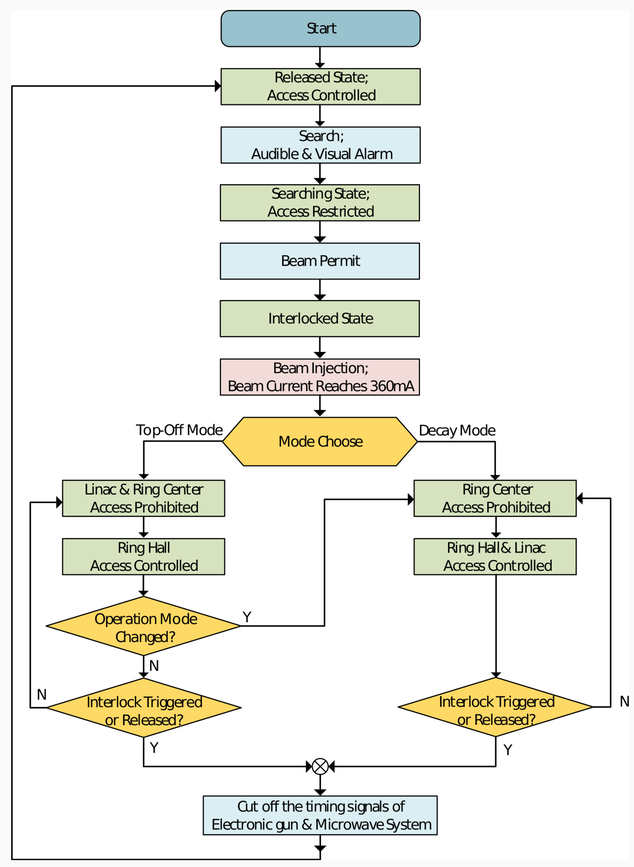


Fig. 4: Workflow Chart of the Safety Interlock System

During the operation of the safety interlock system, there are 3 operation states: the released state, the searching state and the interlocked state.

1. *Released State:* Release the interlock.
2. *Searching State:* Process to establish the interlock.
3. *Interlock State:* Interlock is established, prepared for beam injection and operation mode choose (Top-Off mode and Decay mode).

OPERATION STATUS

The novel PSS was deployed during 2019 summer and has already operated well for more then 2 years. Fig.5 is the picture of the operating access system for safety door No.7 with its door display OPI.

Fig. 5: Photo of the novel HLS-II PSS Door Display OPI

CONCLUSION

1. The safety interlock system, the access control system and the radiation monitoring system are integrated into EPICS environment.
2. The OPIs can monitor the status of security doors and show the real-time interlock logic.
3. The novel HLS-II PSS keeps operating well during the last 2 years.