[WEPMU028]

Development Status of Personnel Protection System for the IFMIF/EVEDA Accelerator

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Abstract

In the IFMIF/EVEDA Project, the prototype accelerator experiments to produce a deuteron (D+) beam with the beam current of 125mA accelerated up to 9MeV at the CW mode are planned. The Personnel Protection System (PPS), which has two functions of radiation safety management and accelerator operation management, has to protect the personnel against unnecessary exposure, electrical shock hazard and the other dangerous phenomena. Since the radiation safety management during and after beam operation is a critical issue for the IFMIF/EVEDA accelerator, PPS with high reliability is indispensable. To realize the high reliability, for PPS design policy, we decided to use and customize proven systems and hardware, and applying dual PLC system. This article presents the PPS design for the radiation safety management.

IFMIF/EVEDA Prototype Accelerator

The D+ beam of 125mA/9MeV at the CW

Injector : ECR Ion Source / Dual Solenoid Type LEBT
D^+ (H_2^+): 100keV
RFQ : 175MHz 5MeV
SRF Linac : 175MHz 9MeV

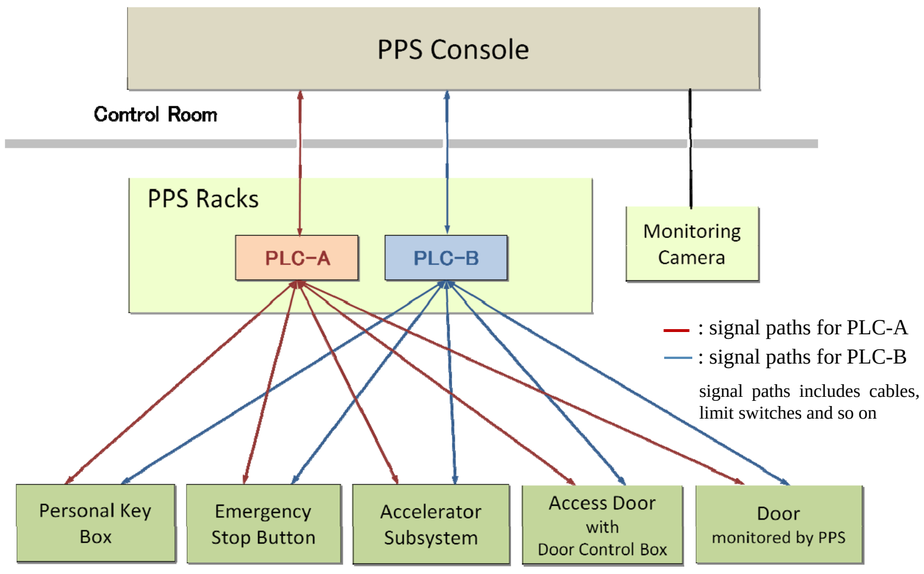
The radiation safety management is very important during and after beam operation.

Design Policy

In order to obtain high reliability

- Using and customizing proven systems and hardware to eliminate risks by initial failure,
- Applying dual PLC system to prevent malfunction.

General Configuration of the PPS



One PLC system consists one set of PLC and signal paths .
(e.g. PLC-A and signal paths for PLC-A)
* PLC (SIEMENS) is used at PPS core (logic) part.
* Signals are transmitted by hardwired from equipments.

•PLC-A and PLC-B system are configured separately and works independently
•PPS only permit some actions when both PLC systems make same judgment.
(e.g. workers can only operate the accelerator subsystems when both systems permit the operation)

PPS realizes high reliability

Access Mode of the PPS

The PPS manages the entering/leaving of the controlled areas according to the classification of the access mode described in the following table.

Access Mode	Status
No Access	"No Access" means a prohibition against all access to the accelerator vault. * On beam operation * While radiation dose is too high to enter the radiation area after beam operation.
Controlled Access	"Controlled Access" means accessible to the accelerator vault and radiation hot area, when the supervisor gives permission. * During preparation for beam operation. * Interval of beam operation. * Maintenance at the radiation hot area
Authorized Access	"Authorized Access" means possible to access to the accelerator vault and radiation hot area, without permission. * Under suspension of accelerator subsystems * During maintenance works

Plane Figure of Building & Layout of PPS Equipments

PPS Console

In the PPS console, it is possible to survey the situation in accelerator vault and shipping bay area by monitoring cameras and intercoms. In addition, the console is also used for monitoring the important points for radiation boundary.

PPS Racks

PPS Racks consist of
* UPS rack,
* PPS control rack (PLC-A),
* Cable connection rack,
* PPS control rack (PLC-B).
(from left to right)

PLCs are installed in PPS control racks (PLC-A and PLC-B), and the both PLCs are same composition, and the PPS is full duplication including signal paths.

The UPS has capacity of 5kVA and ability to supply the PPS equipments without electric power interruption during 10 minutes until startup by a backup generator.

Personal Key Boxes

Yellow keys are used for the accelerator vault.

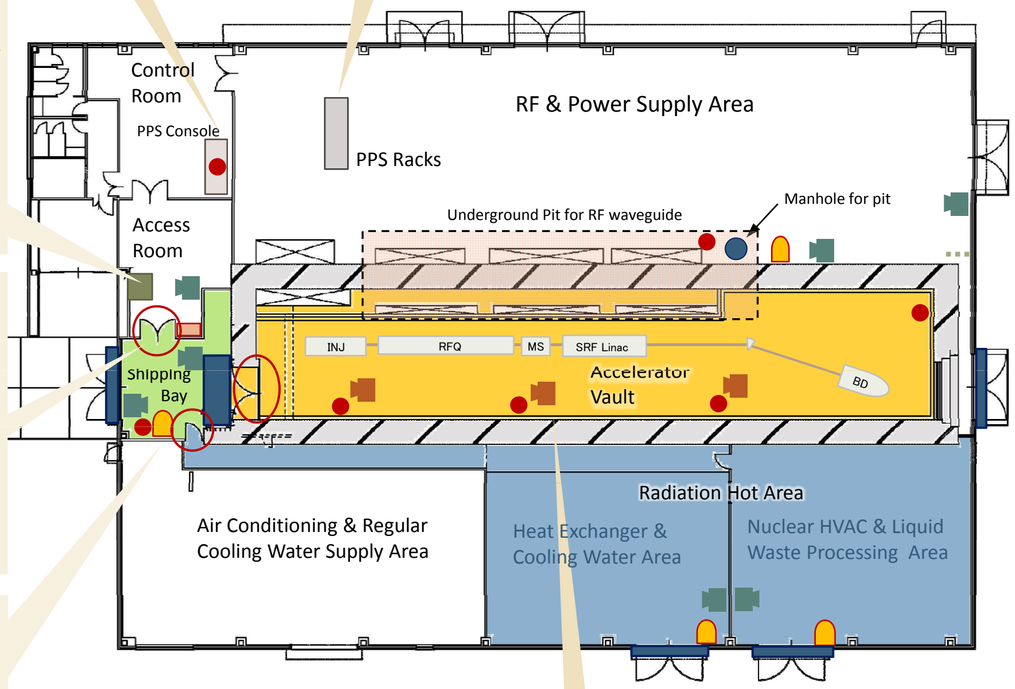
Blue keys are used for the radiation hot area.

Door Control Box ***in Access room***

With yellow and blue key holes

Door Control Boxes ***in Shipping bay***

Set for each access doors.



The controlled area consists of the accelerator vault (yellow part), radiation hot area (blue part) .
* During beam operation, "No Access" mode means a prohibition against all access to the accelerator vault.
* However, the access to radiation hot area for maintenance etc., is possible on beam operation.

Two personal key boxes are prepared.
One is used for entering to accelerator vault (yellow keys), the other is used for entering to radiation hot area (blue keys).

Emergency Stop Button & Monitoring Camera

Emergency Stop Button installed in the Accelerator Vault

Monitoring Camera in the radiation-proof box

Summary

The PPS for the IFMIF/EVEDA prototype accelerator has been designed. In order to manage workers for maintenance, three status modes of "No access", "Controlled access" and "Authorized access" are applied for the accelerator vault area and the radiation hot area. For each status modes, management of workers for the entering/leaving is carried out by the personal keys, the monitoring system.

In the present status, sequence logics and programmed ladder on PLCs are applied, and the PPS has already performed the equivalent radiation safety management.

According to the interface signals between PPS and the accelerator subsystems, the responsible officers both JAEA and European Institutes are discussing details. Each interface signal will be performed at the linkage test with the accelerator subsystems in Europe, before they will be delivered to Rokkasho site.