Conventional Facilities Design of PEFP – Facility Layout and System Configuration

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1. Introduction

The Proton Engineering Frontier Project (PEFP), approved and launched by the Korean government in July 2002, includes a 100 MeV proton linear accelerator development and programs for its utilization and application. As the Gyeongju city was selected as the project host site, we are now preceding successive steps for the conventional facility design.

In this paper, we described the facility layout of the Proton Accelerator Research Center. Among buildings in the research center, we described the facility layout of the Accelerator & Beam Application which installs accelerator related equipments.

We also described several system configurations for the proton accelerator research center such as component cooling water system, HVAC system, power distribution system, fire protection system and wastewater treatment system of PEFP.

2. Facility Layout for the Accelerator & Beam Application Research Area

Accelerator & Beam Application Research Area installs main facilities which are related to the generating and injecting beam (20MeV and 100MeV) from the Accelerator located in the accelerator tunnel, equipments to transport 20MeV/100MeV energy beam generated from the Accelerator to the Beam Experiment Hall by beam transportation line which is shielded by removable wall.

As shown in Fig. 1, the Accelerator & Beam Application Research Area consists of the Accelerator Tunnel, Klystron Gallery Area, Accelerator Assembly Area, Accelerator Control Area, Beam Experiment Hall and Beam Application Research Area.

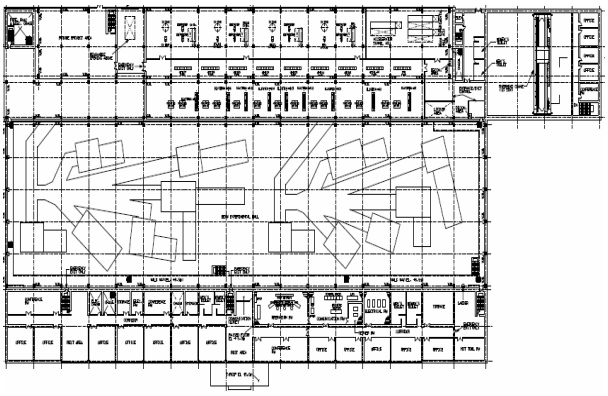

Figure 1. Accelerator & Beam Application Research Area

2.1. Accelerator Tunnel

Accelerator Tunnel is a space for installing LINAC structures such as Accelerator, RFQ, DTL, etc. The inside of the Accelerator Tunnel should be kept at a low negative pressure in operation. In the accelerator tunnel, the neutron flux by a beam loss is relatively low and the Ar-41 concentration is 5.57E-3Bq/cm^3, which is a trivial activation level for a worker to access an accelerator tunnel immediately after an accelerator shutdown. Therefore, air in the accelerator tunnel circulates mainly for the purpose of a cooling.

2.2. Klystron Gallery Area

Klystron gallery area is a space for installing power supply equipment and Klystron to supply high frequency resources to the Accelerator, which is located at the upper area of the Accelerator Tunnel in parallel. We especially considered the spatial arrangement design to make vehicles for the maintenance come in and out. We also installed ACU in the Klystron Gallery Area which enables low negative pressure inside when the accelerator in operation.

2.3. Accelerator Assembly Area

The aim for the Accelerator Assembly Area is to assemble the Accelerator; therefore, it is furnished with equipments and facilities essential for assembling the accelerator. Therefore, this area should be designed to be kept in a clean condition.

2.4. Accelerator Control Area

In Accelerator Control Area, we install devices which are necessary for operating the accelerator. That is, the aim of this area is to provide equipment and facilities essential for operating the accelerator. This area also should be designed to be kept in a clean condition.

2.5. Beam Experiment Hall

The Beam Experiment Hall is to install and operate the equipment using 20MeV/100MeV energy beam generated from the Accelerator. Beam transportation line from the Accelerator is shielded by removable walls and is designed to transport energized beam to the Beam Experiment Hall.

2.6. Beam Experiment Research Area

The aim of Beam Application Research Area is to reside researchers who operate the equipment using 20MeV/100MeV energy beam generated from the Accelerator. It is divided into radiation control areas and non-radiation control areas.

3. System Configuration for the Proton Accelerator Research Center

Main Facilities for the Proton Accelerator Research Center of PEFP are; Heating, Ventilating and Air Conditioning (HVAC) systems, mechanical system, electric power distribution system and fire protection system..

3.1. HVAC System

The aim of the HVAC system of PEFP for each building is to maintain suitable environmental conditions for personnel and operation of equipment, controls and instrumentation in each building of the Proton Accelerator Research Center. In this paper, we describes the HVAC system of the Accelerator & Beam Application Research area; it consists of 4 subsystems such as HVAC system for Accelerator Tunnel, Klystron Gallery, Klystron Gallery Equipment Area and Accelerator Assembly Area. By operating HVAC system, pressure of accelerator tunnel, heat exchanger room and ACU room in the Klystron Gallery maintains slightly negative with respect to outside and adjacent areas to prohibit uncontrolled leakage of contaminated air to outside.

3.2. Mechanical System

Mechanical system of PEFP is composed of component cooling water system, process water system, demineralized water system, compressed air system and wastewater treatment system,

The aim of the component cooling water system (CW) is to provide cooling water to remove heat generated from the equipments in the Conventional Facilities of PEFP. It rejects heat collected to the Tower Cooling Water System by component cooling water pumps and component cooling water heat exchangers.

The function of the Demineralized Water System (DW) is to remove the electrolyte, organic compound, etc. from tap water which is supplied from the process storage tank. It stores the processed demineralized water in demineralized water storage tank to provide component cooling water system after through the dissolved oxygen removal system to protect the equipment corrosion.

Compressed Air System(CA) supplies compressed air for all air operated devices and instruments, pneumatic equipments and other miscellaneous air user points in the conventional facilities of PEFP. CA system consists of the instrument air system and service air system; that is, instrument air system supplies oil-free, dried, filtered, and compressed instrument air for the air operated control devices and instruments in the Accelerator & Beam Application Building, Ion Beam Application Building, Utility Building, etc while Service Air System supplies compressed air for pneumatic equipment and other services.

Wastewater treatment system reduces the contaminants of the wastewater to meet treated water quality as described in Korean Water Quality Conservation Act. Then it discharges the treated water to the outside of the project site of PEFP.

3.3. Electric Power Distribution System

Electric Power Distribution System of PEFP consists of 3.3kV switchgear system, 480V & 220V load center system, 480V motor control centers(MCC) system and emergency power system. For each subsystem, accessories for control and protection are installed.

3.4. Fire Protection System

Fire protection system of PEFP is composed of various fire suppression systems and fire detection and alarm systems. The primary function of the fir protection system is to protect life and property from a fire through detecting and suppressing fires quickly. The fire suppression system consists of fire pumps, underground yard, main loop, fire hose stations, fire hydrants, sprinkler system, clean agent system, and other fire equipments.

4. Conclusions

In this paper, among the facility layout of the Proton Accelerator Research Center, we described the facility layout of the Accelerator & Beam Application which installs accelerator related equipments.

We also described several system configurations design status for the proton accelerator research center such as component cooling water system, HVAC system, power distribution system, fire protection system and wastewater treatment system of PEFP.

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REFERENCES

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