

Fig. 3 (color online) Multi-system integration design and implementation based on 3DE platform.

Table 1 Main Parameters of the Cryomodule sections.

Main parts	Number of Thermostats	Cavity Number of a Thermostat
HWR010	2	9
HWR015	3	6
HWR040	4	6

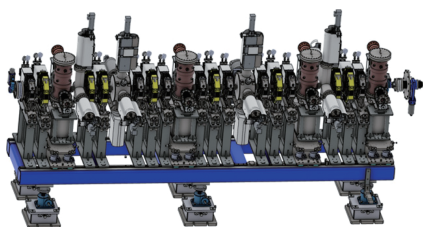


Fig. 4 (color online) Medium energy beamline 3DE model.

Generally, the mechanical integration process of accelerators is dependent on physics design, which effectively realizes the joint design and verification of physics and mechanical systems. The physics parameters of cryomodule sections are given in Table 1. Figure 4 shows the model of medium energy beamline based on beam physics parameters.

8 - 37 Design and Optimization of SSC-Linac and Parallel Beam Supply Water Cooling System

Zhu Tieming, Xu Junkai, Li Yaguang and Su Yalong

SSC-Linac is the first continuous wave high charge state strong current heavy ion linear accelerator in China. Its designed output energy is 1.02 MeV/u, which can realize full ion acceleration from hydrogen to uranium. Then, the addition of DTL3 increases the energy of the SSC-Linac heavy ion beam from 0.58 to 1.02 MeV/u, which can be accelerated to 10.7 MeV/u after SSC injection. DTL4 is designed to further increase the energy of the SSC-Linac to 1.48 MeV/u, and the heavy ion energy can be increased to 15 MeV/u after SSC injection. The purpose of parallel beam supply modification is to make the beam of small lines can be injected into the SSC, and at the same time, the CSR can be injected directly. The SSC-Linac and the parallel beam supply modification ultimately improve the flow intensity and energy of heavy ions in HIRFL device. Therefore, the process circulating water must be used in the whole process to take away the heat generated by the system, so as to ensure the normal and stable operation of the accelerator equipment.

Process circulating water is essential for the normal operation of SSC-Linac and parallel beam supply. The accelerator transformation position is shown in Fig. 1. The process circulating water system is designed according to the beam equipment in Fig. 2. The parameters of process circulating water are provided by the accelerator equipment. The main pipe DN50 leads to the accelerator equipment.

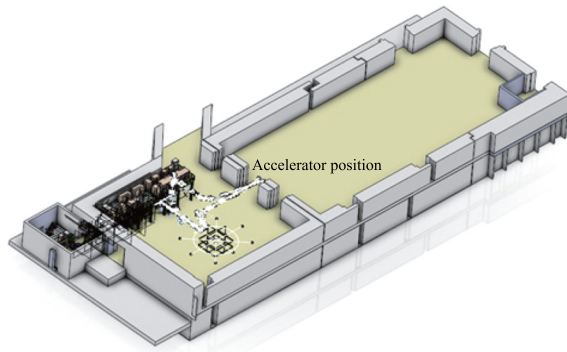


Fig. 1 (color online) Accelerator modification position.

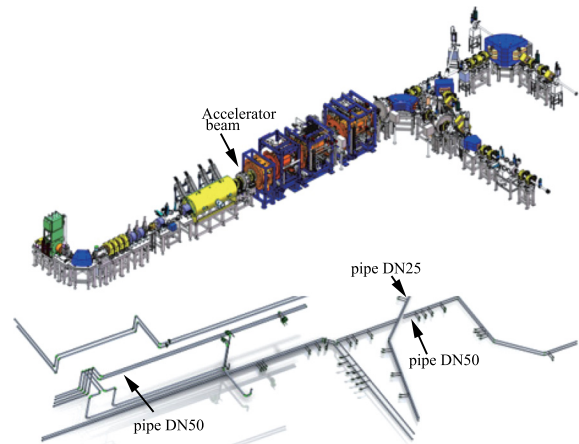


Fig. 2 (color online) Water cooling system design.

In general, the process circulating water takes away the heat generated by the SSC-Linac and the parallel beam supply, ensuring the normal and stable operation of the accelerator system, providing technical support for the acceleration of the U beam to 1.5 MeV/u, and ensuring the insertion of U^{74+} ions into the CSRm.

8 - 38 Upgrade of HIRFL Vacuum Monitoring System Based on EPICS Architecture

Zhang Jianchuan, Zeng Piaopiao, Li Lili and Wu Junxia

The former vacuum monitoring system is designed based on single chip microcontroller and the user interface is written in Java language. This vacuum monitoring system is used to collect the real-time vacuum value of vacuum gauges and fast-closing valve state distributed in SFC, SSC, experimental terminals and other areas of HIRFL to reflect the real-time vacuum environment. This microcontroller-based vacuum monitoring system has been on service for more than 15 years. With the passage of time, the change of on-site environment and the proposal of new monitoring requirements, this system has exposed more and more problems, such as slow refresh of interface data which makes people wonder whether the data is true, incomplete information collected by fast-closing valve, and difficulty in maintenance and upgrading. The requirements for upgrading the vacuum monitoring system are proposed by vacuum personnel. Therefore, the system is upgrade based on PLC controller and EPICS architecture in 2022.

The newly upgraded system hardware adopts Beckhoff PLC controller, and the software interface is based on CSS. The user interface of vacuum monitoring system is shown in Fig. 1. In order to make it clear whether the data is refreshed, a specially designed “heartbeat” signal is designed in the PLC program and then passed to the interface. If the vacuum data is not refreshed in 2 seconds, the display color of the data will change from green to red to give warning information. Meanwhile, a bunch of other functions like the threshold alarm display, waveform display, detailed information of each fast-closing valves are all designed and realized. The upgraded system interface is unified with the CSR vacuum monitoring interface, and has the characteristics of simple maintenance, convenient upgrade and transformation.

Since the system was put into operation in September 2022, it has been running stably and reliably, which provides great convenience for experimental personnel to get a quick and comprehensive understanding of the HIRFL vacuum state.