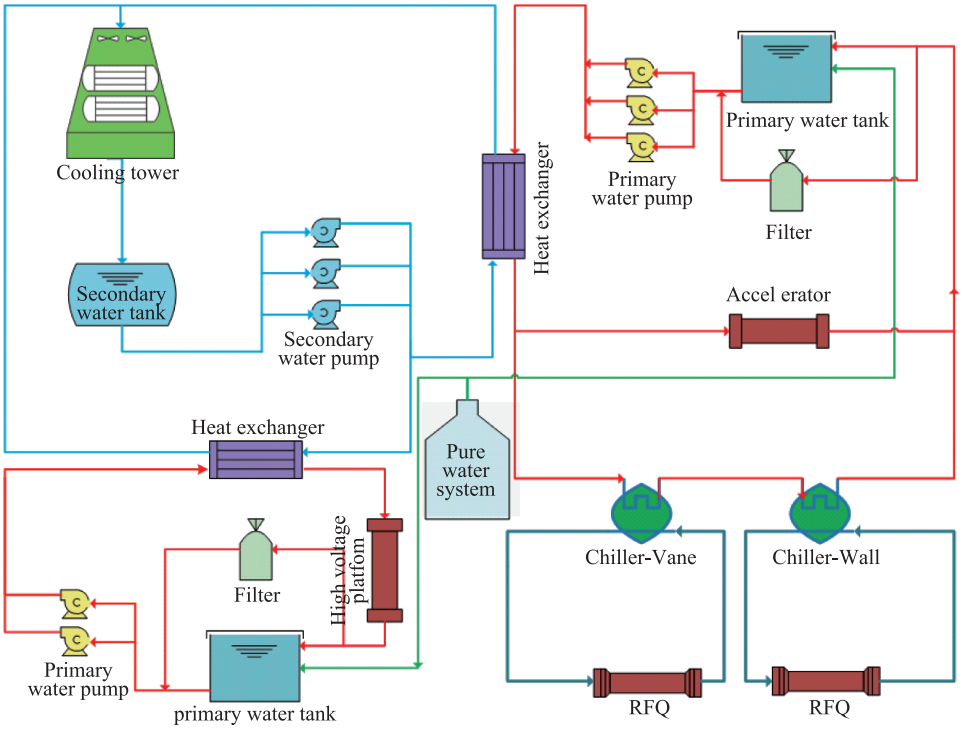

Fig. 1 (color online) Diagram of water cooling system.

According to the equipment requirements, for all equipment, piping, valves, pipe fittings of the water system, stainless steel was chosen; for flange gaskets and other sealing materials need to have the resistance to radiation, anti-aging performance; For equipment, pipes of external circulating water system, carbon steel was selected in order to save project cost.

6 - 24 State Report of 320 kV High-voltage Platform in 2016

Li Jinyu, Liu Huiping, Kang Long and Zhang Tongmin

In 2016, the total operation time is 6 500 h, including 4 500 h for experiments, 740 h for ion source tuning and beam changing, 400 h for machine preparation and beam waiting at the site. The percentages for these activities mentioned are 69%, 11% and 6%. The failure time is 900 h, accounting for 14% of the running time, and this value is at the highest level in years. 37% of the experimental time was contributed to IMP, 11% was to institutes other than IMP, 47% to universities and 5% to enterprises (shown in Fig. 1). Among the research purpose, 71% of the experimental time was for material research, 20% for atomic and molecular dynamics, 9% for plasma physics, nuclear astrophysics, and atom and molecular spectroscopy (presented in Fig. 2).

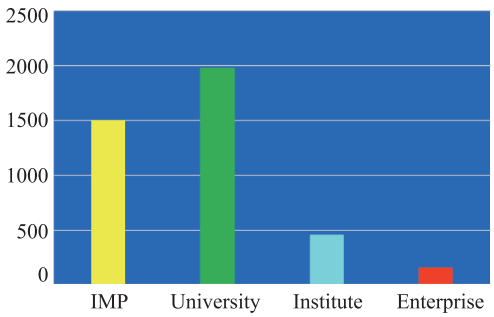

Fig. 1 (color online) Beam time distribution in terms of affiliation.

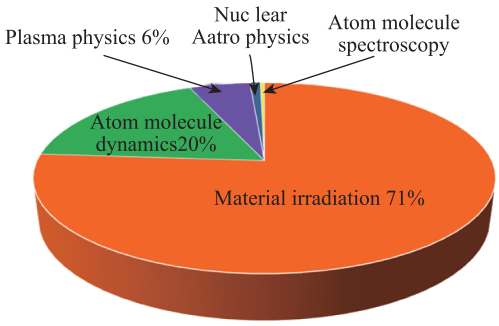

Fig. 2 (color online) Beam time distribution in terms of research area.

During 2016, more than 120 ion species from 16 kinds of gas elements and metal material were produced and delivered at 320 kV platform, such as H, He, C, N, O, Ne, Ar, Kr, Xe, Bi, Fe, Li, Ni, and so on. Among them, Li and Ni ions beams were newly tuned. The ion beams were changed about 233 times according to the user's requirements. The energy of ion beams ranged from 10 keV to 7 MeV, the extraction voltage was 10∼280 kV.

In total 126 physical experiments were carried out by researchers from 27 universities, enterprises and institutes at 320 kV high-voltage platform for multi-discipline research with highly charged ions, 98 of which were conducted by the researchers from other affiliations than the Institute of modern Physics (IMP), the percentage was 78%. A number of outstanding experimental results were achieved and about 30 excellent SCI papers were published, 10 of which were written by IMP.

Two functional improvements projects, "upgrading of the 320 kV HV platform control system" and "functional upgrading of the 320 kV HV platform heavy ion production", passed the evaluation successfully and got the financial support. Both projects were progressing on schedule. Additionally, the platform power supply system and the water cooling system were upgraded and improved. A cooling water purification plant was installed and the water resistance enhanced from 0.8 MΩ·cm to 5.0 MΩ·cm. Besides, the way of water supply was changed and the water pipe of magnet was replaced.

On October 12, the first national user communication meeting of 320 kV HV platform was held successfully. Many important achievements and progresses gotten depending on 320 kV HV platform in different research field were shown and the communication between the related disciplines were strengthen. The contents of the meeting were original and the academic exchange was plenitude. Participants spoke highly of the platform operation and beam quality. Further performance improvement of the platform was expected to maintain the international advanced level.

6 - 25 Cryogenic System at IMP in 2016

Zhang Junhui and Guo Xiaohong

In the year of 2016, the work of cryogenic group is mainly focused on cryomodules, operation of cryogenic system and preliminary design of CIADS cryogenic system.

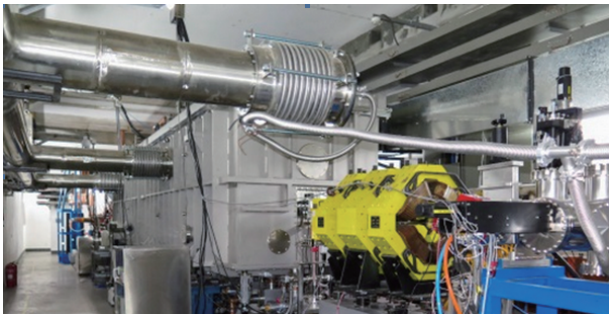

Fig. 1 (color online) The two cryomodules in ADS injector II.

We completed the design, assembling and running of cryomodules in 2016, such as HCM6-2, HCM6-3 and SCM6-1. We tested mechanical character, sealing and vacuum performance of cryomodules by the means of cooling down and warming up several times before assembling in the injector II. So, they have been running stably. And ADS injector II with two cryomodules got proton beam with 10.06 MeV@1.16 mA for 28 min in CW mode, with 10.06 MeV@11.7 mA in pulse mode. Fig. 1 shows the two cryomodules in injector II. The temperature, pressure, helium level of cryomodules can be read and written by cryogenic control system. All of these parameters matched design requirements. The helium pressure can be controlled at 1.05 bar ±1.5 mbar, and helium level at 160 mm±10%.

From July, 2013 up to now, Cryogenic System has been running 2 500 h continuously and reliably, which supplies liquid helium for cryomodules, vertical testing of superconducting cavity and other cry-testing. The cooling capacity of LR280 can reach at 850 W@ 4.5K and 280 L/h of liquefaction rate. Cryogenic system has achieved closed-loop operation and recycle helium automatically, which did great contribution to cavity and magnet testing. The new helium regulating and distribution system has been put into use in march this year. Which use multi-channel pipes for helium transfer with five valve boxes on it for regulating helium quantity of each cryomodule. This new transfer line can greatly reduce heat leak, and it is in a good running condition now.

Another main work of cryogenic group in 2016 is the preliminary design of CIADS cryogenic system. The Accelerator of CIADS (China Initiative Accelerator Driven System) will be built in the nearly future at IMP. All the superconducting cavities will be running at 2 K. So, a helium cryogenic system has been designed according to the requirements of the CIADS accelerator. The total heat load of the cryogenic system is about 2.5 kW at 2 K, 1.6 kW at 4.5 K and 6.1 kW at 60 K. And the total 4.5 K cooling power is 11 kW. We did preliminary design of cryogenic system, calculated the heat load, designed the cryogenic process. Fig. 2 is the simple flowchart of CIADS cryogenic system. The detailed design will be start in the beginning of next year.