Maintenance of vacuum for accelerators

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The maintenance of vacuum for accelerators in 2015 is described as follows.

At the RILAC on January 2015, pressure rises were found in cavities No.5 and No.6. The pressures were on the order of 10^{-4}Pa. A helium leak detector was used to find the leak points of the vacuum. The cavities had inner cylinders which were in nested structure and several parts around the chamber. When helium gas was blown on the chamber, the helium leak detector reacted. However the exact location of the leak could not be pinpointed because the helium gas was spread on the chamber. Scratches and cracks on the chamber would have high possibilities of having a leak point. To find the scratches and cracks, dye penetrant inspection was adopted. The scratches and cracks on the surface can be seen using this method. One scratch on the port of the cavity No.5 and 3 scratches on the port of the cavity No.6 were found. A sealing agent was applied to the scratches. The pressure in cavity No.6 was improved to an order of 10^{-6}Pa. However the leak I cavity No.5 could not be fixed. In July, a vacuum leak was found in a chamber called 014. The point of the leak was in a gate valve. Hence, this gate valve was replaced with another one. The vacuum leak was fixed. A controller of a pressure gauge (TPG300) broke down in March. The causes were that a condenser and DC/DC converter were broken. Both the condenser and converter were replaced with new ones. The controller of the pressure gauge was repaired.

The operations in the cyclotrons are described as follows. After summer maintenance in August, the air in the chamber of the AVF could not be evacuated. The chamber was deformed so that the vacuum in the chamber could not be sealed. However, the air could be evacuated when a magnet of AVF was excited. This phenomenon is explained as follows. The temperature of the seals would increase owing to the excited magnet. The gap between two sealing faces became narrow and the leak rate of the vacuum decreased. This phenomenon occurs often. Then, polls were put in the chamber to support the deformed chamber. However some slacken bolts used with the polls were found. The cause of the deformation of the chamber was these slacken bolts. To fix the bolts, the bolts replaced with those with double nuts. In September, vacuum leaks occurred in RF No.2. The leaks were in an insulator and coupling terminal. The O-rings used in the two pats were replaced with new.

The RRC usually runs on a pressure on the order of 10^{-6} Pa. However there was a buildup of pressure in cavity No.1. The pressure was on the order of 10^{-5} Pa. Therefore, the cavity was checked for a leak of vacuum. Leaks were found in cooling pipes No.48 and 52. However the location of the leaks could not be pinpointed. To investigate the leak points, the cavity should be taken apart. To fix the leak, the cavity should be repaired. The other leak of vacuum occurred in cavity No.1 in September. The leak point was in a broken insulator. To fix the leak, the insulator was replaced with a new one. In January, the pressure in cavity No.2 increased to the order of 10^{-4} Pa. Residual gases in the cavity were measured using a quadrupole mass spectrometer. A large spectrum of H_2O was found. The cause of pressure increase was that water leaked from some cooling pipes. The water was leaked from some pipes at cavity No.2. Two pipes having leakage were found using compressed air in March. In June, the cavity was exposed to the atmosphere and the cooling pipes were checked. Several water joints were slacked. The joints were tightened and water leak was fixed. A bellows connected with cavity No.2 had a leak point. The leak point was fixed using sealing agent.

At the fRC, the pressure of the vacuum in the cavity decreased when the magnet was excited. This phenomenon could be due to the fact that excitation of the magnet heated part of the ceiling and the gap between the ceiling faces became narrow owing to the heat. Despite a leak point in the cavity, there will be no problem in running the fRC.

At IRC, the pressure in the IRC was kept high on the order of 10^{-4} Pa. In October, a broken glass of a viewing port was found in the South Pole-box. The viewing port was replaced with a blank flange. The pressure of the vacuum was enhanced to the order of 10^{-6} Pa.

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