Upgrade of AVF cyclotron

T. Yorita, H. Kanda and M. Fukuda

The program of upgrading AVF cyclotron is being carried on. Its purpose is to increase the beam intensity for nuclear physics, RI production and secondary particles applications. For example, intense DC muon is useful for elementary particle physics and muon applications, intense white neutron source is for evaluation testing of semiconductor devices and mass production of short-lived RI like At-211 for targeted alpha therapy. Intense primary beam is also useful for precise measurements of nuclear structures. For that purpose, increasing beam intensity by 5 to 10 times and improving beam brightness and transmission are to be achieved.

First, the upgrade program for ion sources and low energy beam transport (LEBT) line before injection to AVF cyclotron was carried out in 2017. To improve beam brightness, acceleration voltages of all the ion sources have been changed from 15 kV at present to 50 kV and the design of LEBT for 50kV beam has been done. A new ion source, Duoplasmatron, for proton and He beam also has been introduced.

In 2018, the design of AVF cyclotron modification itself and the construction of some components have been done. About the new cyclotron, the magnetic poles and the yokes, and the extraction beam line will remain the same. Thus, the related parameters: the K-value of 140 MeV, the extraction radius of 100 cm, and the maximum averaged field of 1.65 T are the same as before. The Dee electrode will be changed from single one to double for the purpose of increasing turn separation at the beam extraction as the result of increasing acceleration voltage per one turn. The two Dee electrodes have opening angle of 87 degrees. The frequency range is 18~36 MHz and acceleration harmonics are 1, 2, 3, 6. The central region with inflector, puller, phase slit, etc. will be modified for matching 50kV injection.

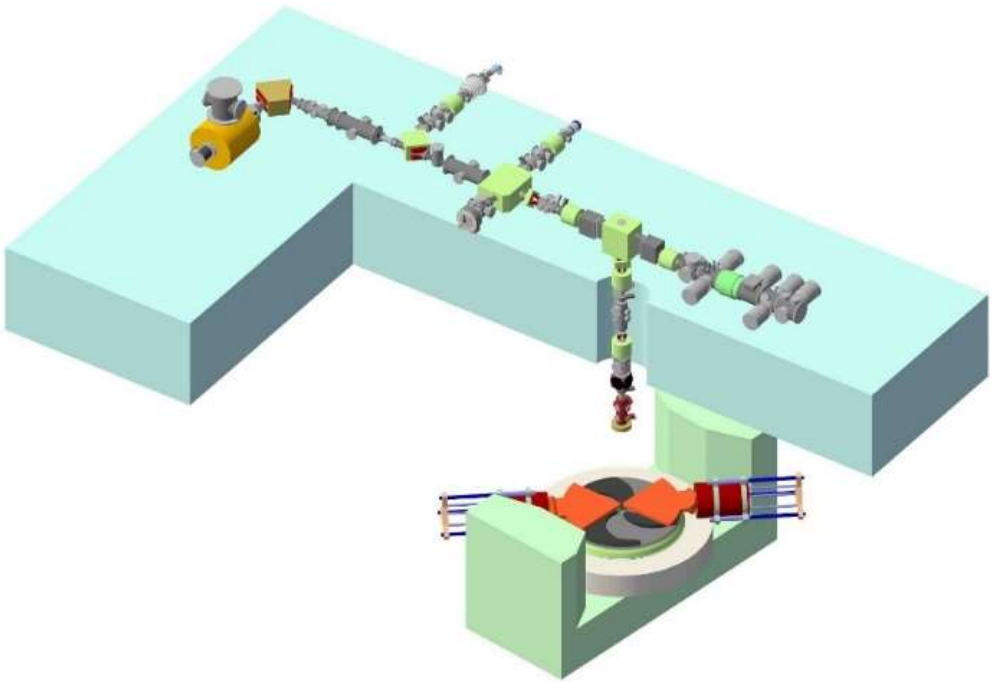

Figure 1. Conceptual diagram of Ion sources, LEBT and AVF cyclotron.