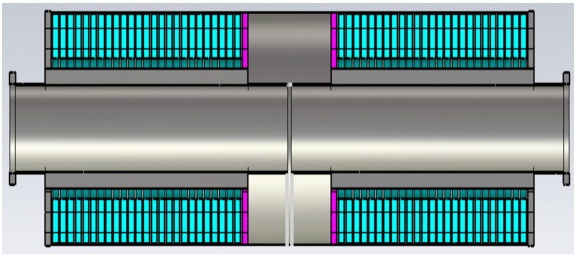

Fig. 6 (color online) Ferrite loaded cavity of synchrotron in HIAF.

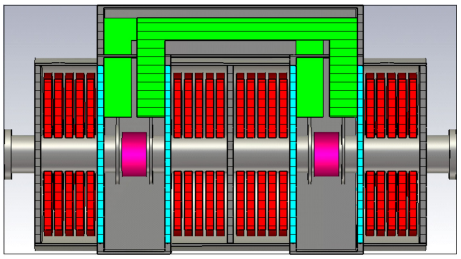

Fig. 7 (color online) Magnetic alloy compressor cavity in HIAF.

Reference

[1] Ruixia Tian, Xianwu Wang, Peng Jin, et al., High Power Laser and Particle Beam, 26(2014)10.

6 - 34 7 MeV Compact Heavy Ion Cyclotron RF System

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Tian Ruixia, Ren Hongwen and Gao Yihai

The 7 MeV/u compact heavy ion cyclotron has been developed for HIMM injector at Institute of Modern Physics. The cyclotron was designed to operate at 31.02 MHz, with a final extraction energy of 7 MeV and beam current of 10 μA. The cyclotron RF system is an important part, which is required to provide cavity voltage up to 70 kV and cavity field control within 1% amplitude & ±0.5° phase.

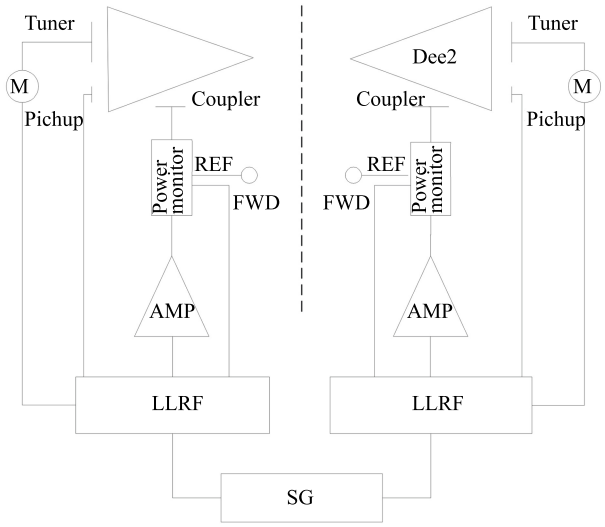

Fig. 1 RF system block diagram.

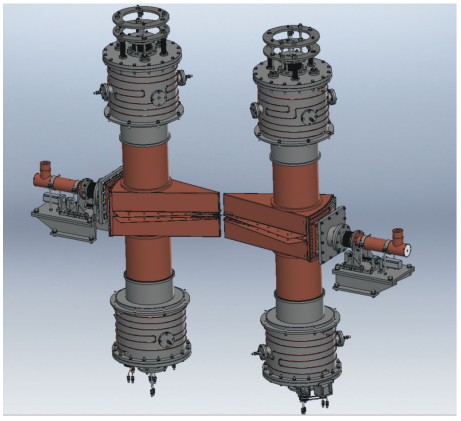

Fig. 2 (color online) The model of medical cyclotron RF cavity.

Fig. 1 shows a block diagram of the RF system, which is composed of two generators, two cavities and two sets of low level RF control systems. The generators includes electronic tube, power supply, water & air cooling and the interlocks. The generator power is 50 kW. The cavities' resonant frequency is 31.02 MHz and structure is 1/4 wave-length. Each cavity adopts coarse and fine tuning method by the local movable sliding short and inductor ring separately. The mode & main parameters of cavities are shown in the Fig. 2 and Table 1. The low level RF control system includes cavity field controller, cavity resonance controller and reference generator.

Table 1 Main parameters of the cavities.

Cavity structure	Parameter
Inner stem diameter/mm	100
Outer diameter/mm	345
Outer diameter(upper)/mm	500
Dee radius/mm	770
Cover radius/mm	858
Dee angle/(°)	33
Cover angle/(°)	34

The cyclotron RF system has been designed, constructed, installed, and commissioned. The cavity Dee voltage was calibrated by X-ray. The Dee voltage achieved 70 kV. An example of one cavity result is shown in Fig. 3. The amplitude and phase stability with 24 h are better than 0.5% and ±0.5° separately. An example of one cavity result is shown in Fig. 4.

The cyclotron RF system has operated for three months and completed the beam commissioning. The system stability is validated. The cavity sample is shown in Fig. 5. The beam commissioning result is shown in Fig. 6.

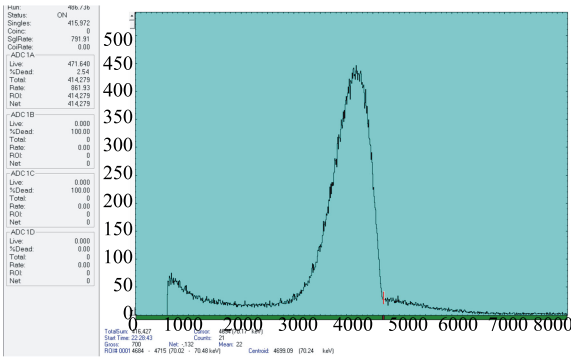

Fig. 3 (color online) Dee voltage test result.

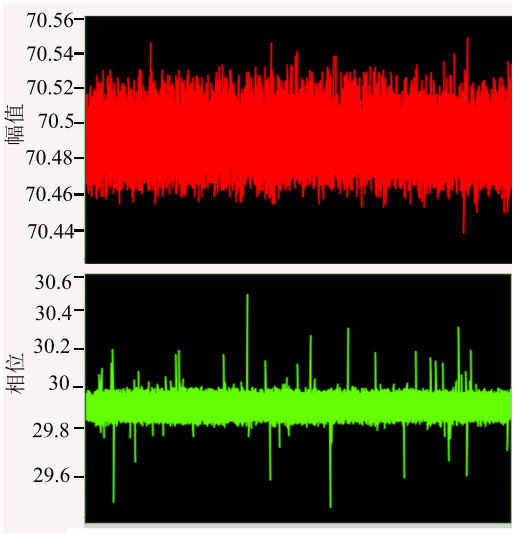

Fig. 4 (color online) Amplitude and phase stability with 24 h.

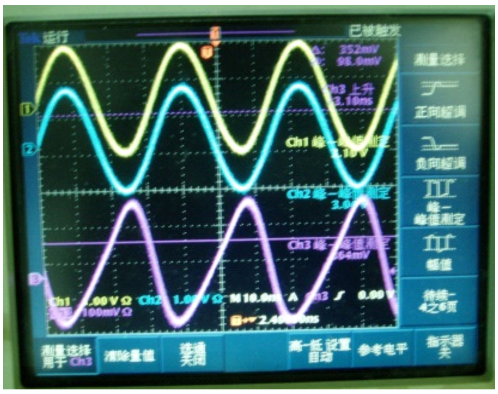

Fig. 5 (color online) Cavity sample signals.

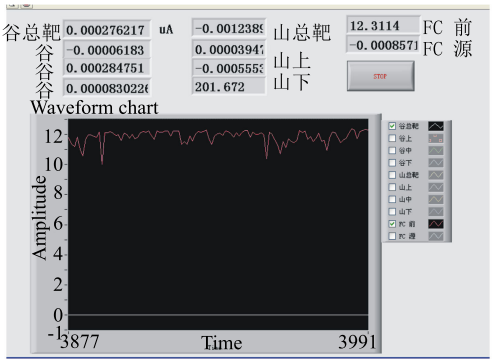

Fig. 6 (color online) Beam current test result.