Fortunately, the power conditioning[2] and commissioning have been completed for three months, the experiments of continuous 10 mA beam were carried out to measure on its energy, transmission efficiency and emittance, which agreed well with the dynamics goals. Now the effect from strong beam load was also solved a month ago, the commissioning situation with 10mA was shown in Fig. 2(b).

On July 18th, 2014, the measurements about RFQ from many national famous experts were done through testing the all beam results, including output energy, beam intensity, and so on. The test result of the 10 mA CW beam which runs several hours indicates RFQ development including its RF system fully meet the requirements of original design goal.

References

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[2] Hartmut Buttig, A. Arnold, A. Buchner, et al., Nuclear Instruments and Methods in Physics Research Section A, 704(2013)7.

6 - 7 Mechanical Design and Fabrication of 162.5 MHz Buncher for C-ADS Injector II

Niu Haihua, Zhang Bin, Yuan Chenzhang, Huang Shichun, Jia Huan and Zhang Shenghu

Two room temperature quarter wave resonator (QWR) buncher cavities with frequency of 162.5 MHz have been designed as parts of the medium energy beam transport line (MEBT1) for injector II in China Accelerator Driven Sub-critical System (C-ADS) project in order to focus the beam longitudinally, thus keeping the bunch length and matching the beam to the acceptance of the superconducting linac.

Buncher is one of major equipments in MEBT1. Fig. 1 shows the layout of the MEBT1. Its structure directly affects the performance of MEBT1. Buncher cavity takes an open-ended quarter-wavelength coaxial line cylinder type structure, the mechanical design of buncher cavity was done according to the physical design, adequate consideration ought to be given to the factors of electromagnetic field distribution, power coupling, frequency tuning, cavity cooling and manufacturing, and so on.

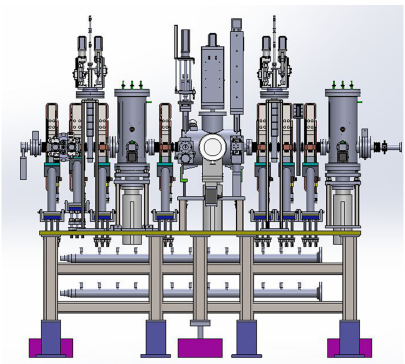

Fig. 1 (color online) The layout of the MEBT.

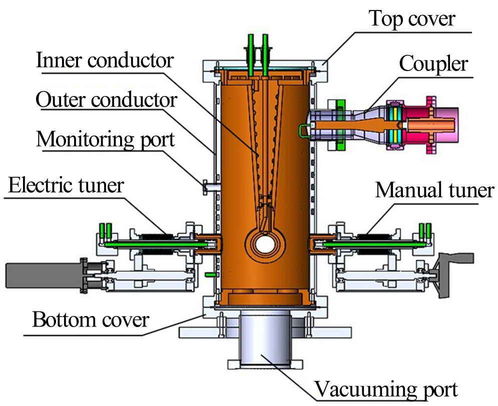

Fig. 2 (color online) The mechanical structure of buncher.

Cylinder type vacuum-tight cavity was applied to meet the needs of high thermal conductivity, high conductive, air impermeability and weldability, which mainly includes outer conductor, inner conductor, top and bottom vacuum end cover, left and right drift tube, coupling and tuning port, vacuuming and monitoring port, cooling water passages, *etc.* Coupling port is equipped with power coupler and located in the place of strong magnetic field in order to realize the buncher matching with the power source. Monitoring port is equipped with feed through to monitor cavity voltage and provide the signal for phase and amplitude control loop. Factors

Fig. 3 (color online) Test site of buncher.

such as beam load, temperature changes and frequency sources unstable would make cavity detuning, so it is necessary to use tuner for dynamic correction. Furthermore, the offset of cavity resonant frequency caused by mismachining tolerance and the welding deformation can also be compensated by tuner. Vacuuming port is located at the bottom of the cavity with the ion pump. The mechanical structure of buncher is shown in Fig. 2.

In June 2014, the fabrication of bunchers and their parts were completed and then passed high power condition test. The results agreed well with the design requirements. The test site is presented in Fig. 3. At present, the two bunchers are installed in MEBT1 for beam commissioning and work in good condition.

6 - 8 LLRF Control System for ADS Injector II

Gao Zheng, Zhu Zhenglong, Wang Xianwu, Zhang Ruifeng, He Yuan, Chang Wei and Chen Qi

The ADS Injector II is a linear superconducting accelerator, which is made up of the four vane type RFQ, MEBT and superconducting cavities. The amplitude and phase stability of all RF resonant cavities need to be controlled precisely by the low level radio frequency (LLRF) control system. Fig. 1 is the block diagram of the LLRF control system, which is composed of the RF synchronous signal distributor, LLRF system and solide state RF high power amplifier.

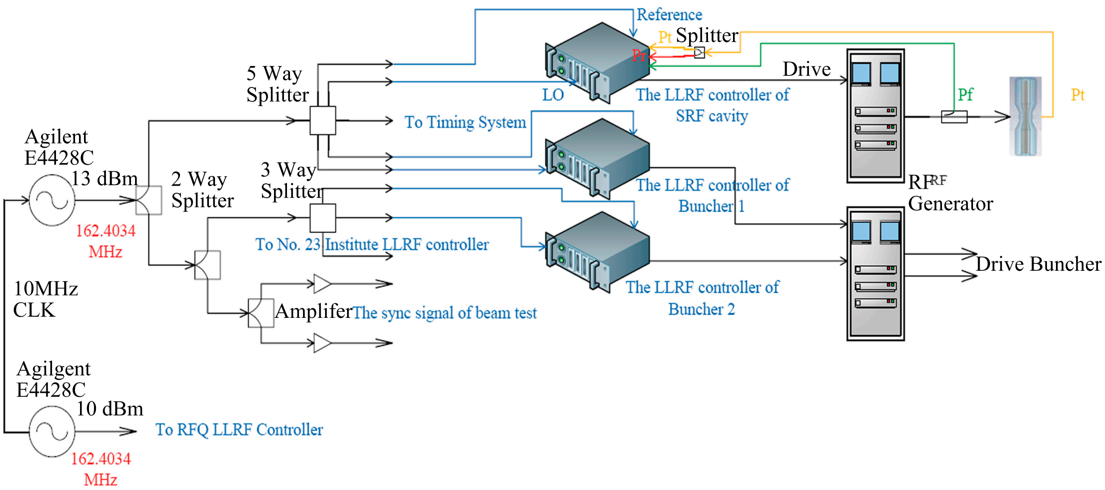

Fig. 1 (color online) The block diagram of the LLRF control system.

The LLRF control system which used to control buncher and superconducting cavity is developed by IMP, CAS. Fig. 2 shows the system architecture of one LLRF system, which consists of cavity amplitude stability controller, phase stability controller and the cavity resonance frequency controller, and the operating frequency of it is 162.5 MHz. The system is an all-digital closed-loop feedback control system and based on the IQ quadrature sampling demodulation technique.

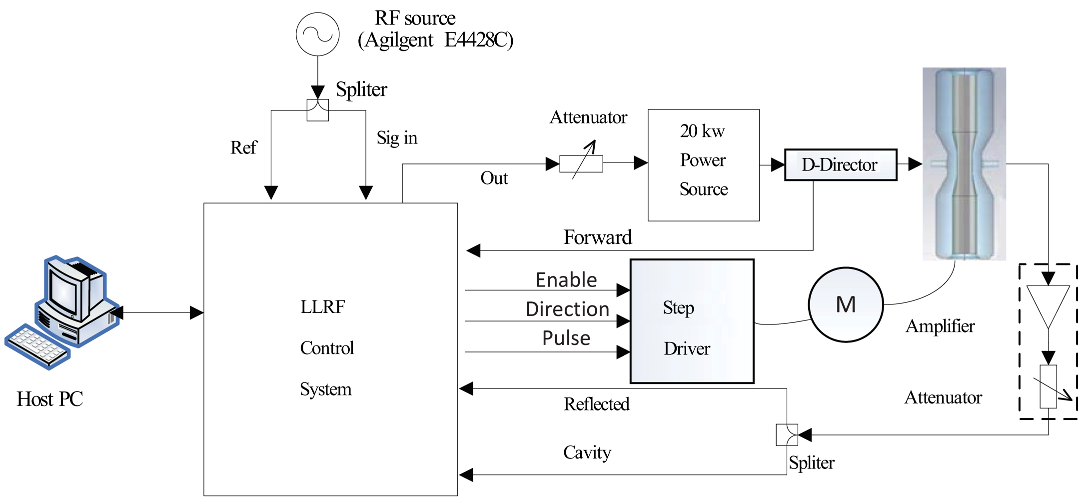

Fig. 2 (color online) The system architecture of one LLRF system.