# LATEST DEVELOPMENTS OF A C-BAND 2MEV ACCELERATOR

Wei Bai#, Ming Li, Lijun Shan, Xuming Shen, Zhou Xu
Institute of applied electronics, china academy of engineer physics
Sichuan Mianyang, 621900, CHINA

*Abstract*

A C-band 2MeV accelerator is developed at CAEP in China. This research is aimed at developing a compact accelerator used as X ray source for industrial usage. At present, the C-band accelerator has been developed successfully. We have carried out a lot of research work based on the accelerator, including test of X ray energy, focus and dose rate etc. This paper shows the latest experimental results and application research status on the C-band accelerator.

## INTRODUCTION

Accelerator miniaturization is a major trend of technology development for accelerator. Because the whole dimension of the accelerator can be decreased together with its operating frequency increased, Development of high-frequency accelerator has become an important method of technology development for accelerator. However, advancing the working frequency of the accelerator is restricted by the accelerating cavity processing, debugging and the requirements of operation stability. Because higher working frequency of the accelerator, more strict requirements for the cavity processing, more difficult to debug and more difficult for accelerator's steady operation. At the same time, advancing the working frequency of the accelerator is restricted by the development technology of the corresponding microwave sources. In recent years, x - band(about 9.3 GHz) high-frequency accelerator has been successfully developed internationally. The development effort of X-band and C-band standing wave accelerator has been carried out in China.

A C-band 2MeV standing wave accelerator has been successfully developed by Institute of Applied Electronics, China Academy of Engineering Physics, in 2013. At present, the accelerator runs stably. Technical indicators meet the design requirements. At the same time, we developed a compact device of high-energy industrial computed tomography (CT) device based on the accelerator. Using the device we have carried out CT image formation experiment. The experimental results show that, it has a higher spatial resolution for image forming, and its imaging quality is good. This paper introduces the research and development status of the c-band standing wave accelerator, and shows some experimental results.

## DEVELOPMENT OF C-BAND 2MEV STANDING WAVE ACCELERATOR

### *Development of C-band Accelerator*

The major components of the C-band 2MeV standing wave accelerator device consists C-band standing wave accelerating tube, isolator, microwave sources, and etc. In which, c-band accelerating tube is an important part of the accelerator. It has compact structure and light weight. A C-band coaxial magnetron is used as the microwave sources for the accelerator. And a C-band three ports isolator used as the microwave reversal isolator. The weight of the x-ray source developed based on C-band compact accelerator is only 150kg. As shown in Figure 1.

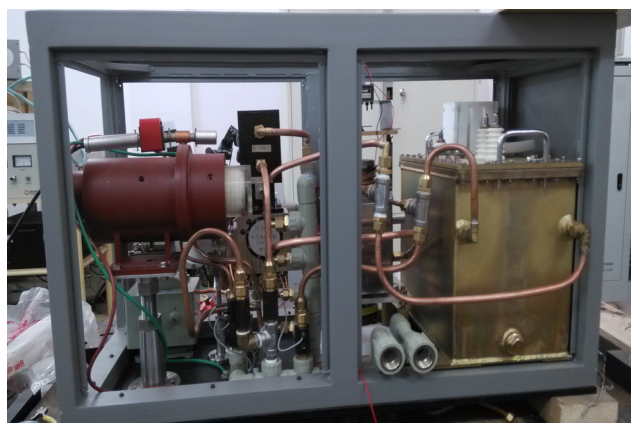

Figure 1: The C-band 2MeV standing wave accelerator.

### *Power Test of C-band Accelerator*

At present, we have finished the experimental test on the c-band accelerator. The parameters have been tested such as energy, pulse width, repetition rate, maximum dose 1 m before the tungsten target, and etc. Table 1 shows the tested parameters of the accelerator.

Table 1: The Tested Parameters of the C-band Accelerator

| Item | energy | Pulse width | Repetition rate | Maximum dose |
|---|---|---|---|---|
| unit | MeV | μs | Hz | rad/min·m |
| result | 2.5 | 4 | 50～250 | 204 |

#bweimail@163.com


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## COMPACT CT DEVICE DEVELOPMENT

### *Development of the CT Device*

We develop a compact computed tomography (CT) device based on the C-band accelerator. The device consists of mainly components such as x-ray source of C-band accelerator, flat panel detector sensor, numerical control rotary table, and so on. As seen in figure 2. Integrated design of the structure is adopted for the device. Radiation source, detector, and rotary table are all located in the same foundation bed. The whole structure is compact.

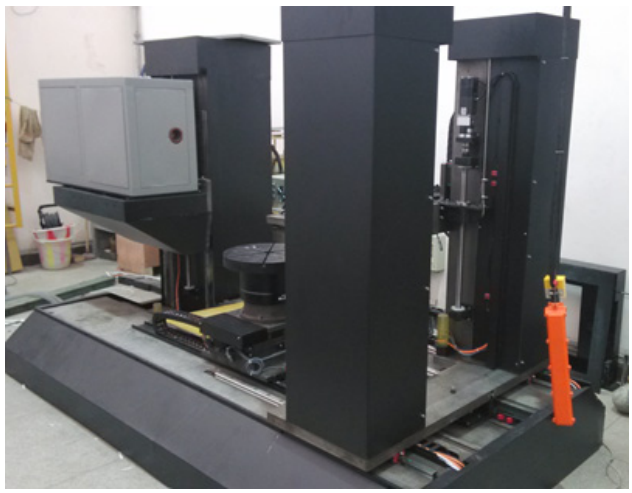

Figure 2: The high-energy industrial CT system based on C-band accelerator.

### *Experiment on the CT Device*

Using the CT device, we have carried out CT image formation experiment. We perform tomoscan on a test sample (as is seen in figure 3) and the small hole on it 1mm in diameter can be seen from the tomographic image. As seen in the figure 4. Figure 5 shows the reconstructed image of a valve.

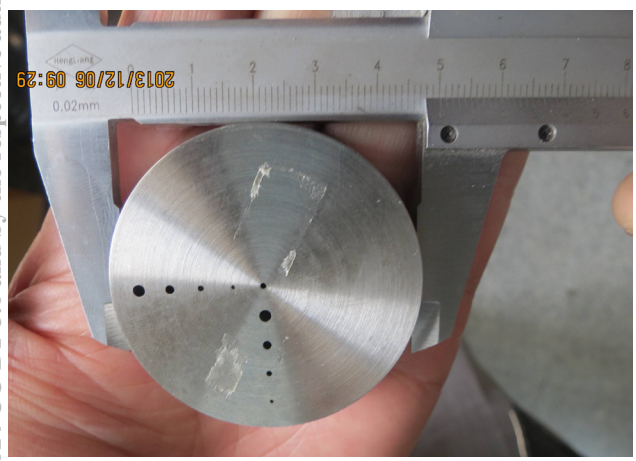


Figure 3: Test sample.

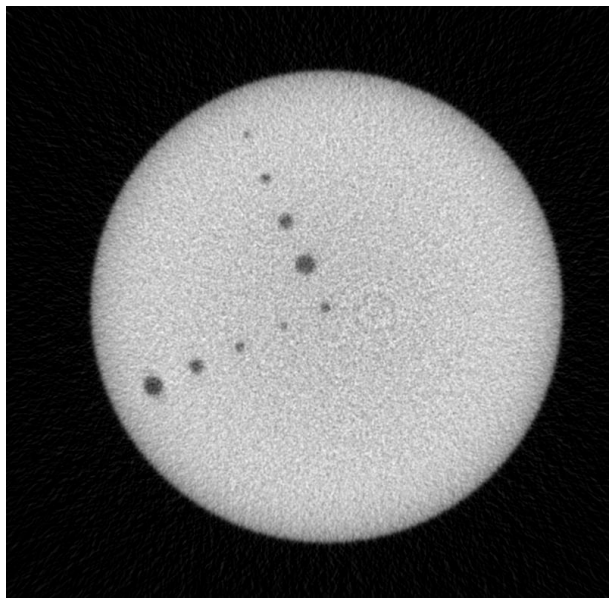

Figure4: The tomographic image of the test sample.

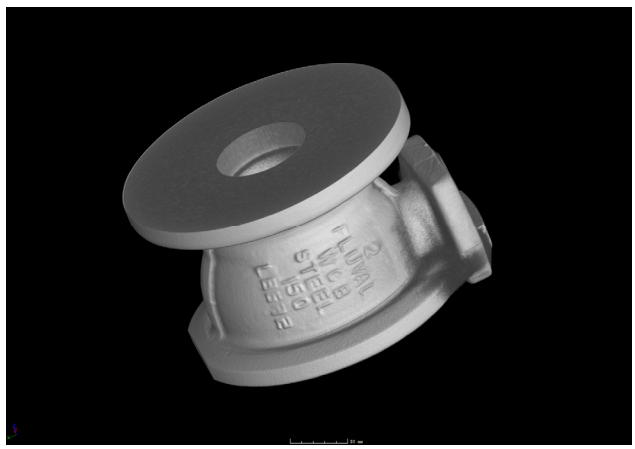

Figure 5: The reconstructed image of a valve.

## CONCLUSION

It has compact structure and light weight for C-band accelerator. It can be used for developing miniaturized, movable, and portable accelerator x-ray source used for miniaturization computed tomography system, and it has potential of wide application prospects. We have developed a C-band standing wave accelerator as well as a compact computed tomography device based on the accelerator. And correlation experimental research has been launched. Now the computed tomography device has been put into commissioning. And the commissioning is in good condition.

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