

Development of a 1.5 GHz High-Power CW Magnetron for SRF Accelerator

Li Wenliang¹, Liu Youchun², Sun Lingbin², Zhou Bowen¹, Zhang Pengjiao¹, Ke Yijing¹, Zhao Lei³, Hou Rui³, Li Junzhou³, Zhang Liping³, Sun An^{1,3}

¹PLAI, Nanjing University, Nanjing 210046, China

²Nanjing Sanle Electronic Information Industry Group Co., Ltd., Nanjing 211899, China

³Andesun Technology Group Co., Ltd., Nanjing 210046, China, China



Abstract

An 1.5 GHz, 13.5KW CW high-power magnetron for a superconducting RF accelerator has been developed by Andesun Technology Group Co., Ltd. with Nanjing Sanle Electronic Information Industry Group Co., Ltd., in order to replace the klystron, that could reduce the power source cost to about one-third. The cavity, output power antenna and coupling door-nob have been optimized by using CST Studio. Testing results have shown that the resonance frequency and output power have met the requirements, and the efficiency of the magnetron is higher than 78.45%.

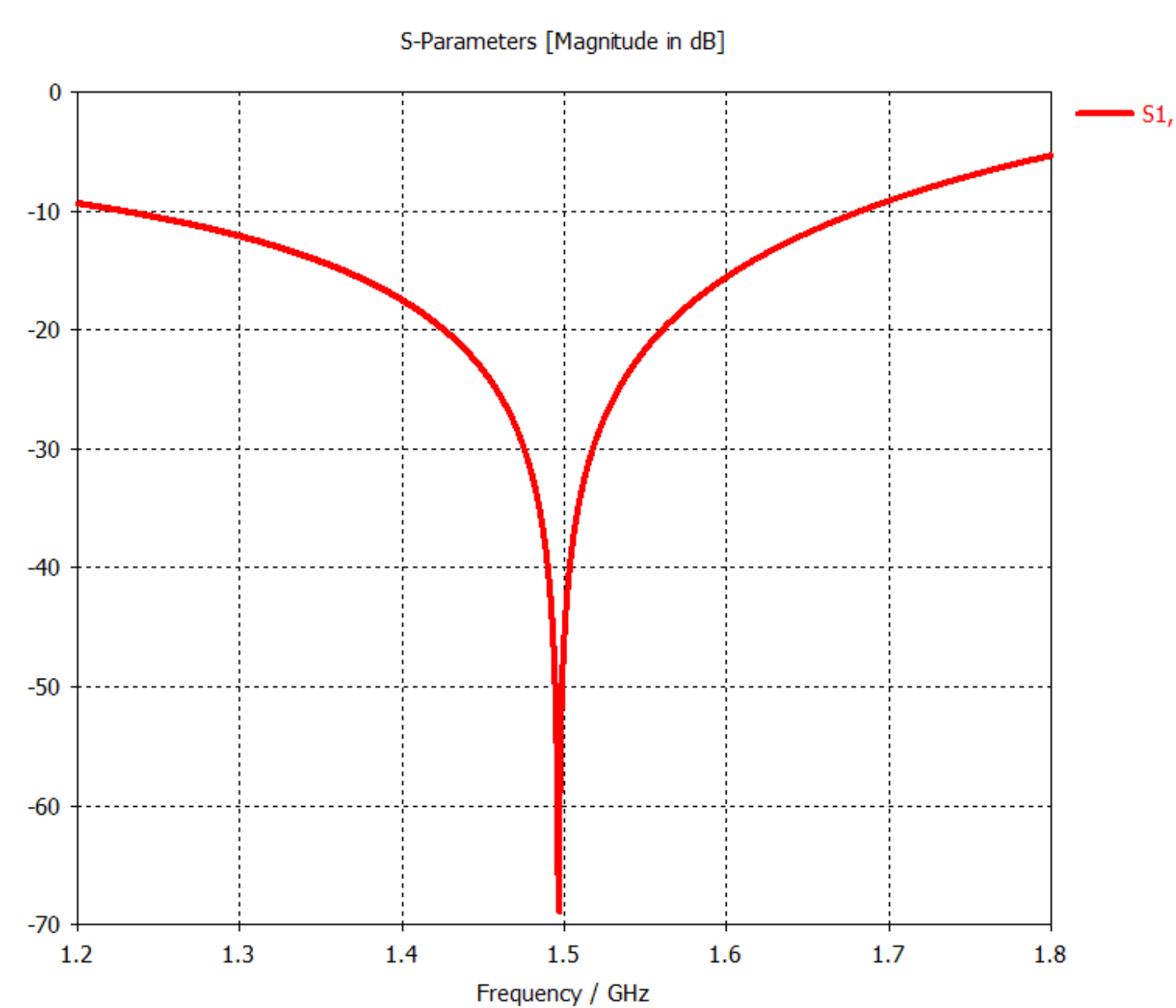
1. Introduction

- Using a magnetron instead of a klystron as a microwave power source for an SRF accelerator can reduce operating costs by about one-third.
- An 1.5 GHz, 13.5KW CW high-power magnetron has been developed by Andesun Technology Group Co., Ltd. with Nanjing Sanle Electronic Information Industry Group Co., Ltd.
- The prototype measurement shows that the output power of the magnetron reached 14.23kW, and the whole tube efficiency is 78.45%.

2. Design of the magnetron

2.1 The parameters of the magnetron

Parameter	value
Working frequency	1.5 GHz
Average output power	13.5kW
Peak power	17 kW
Efficiency	78.45%
VSWR	< 1.14
Way of working	CW

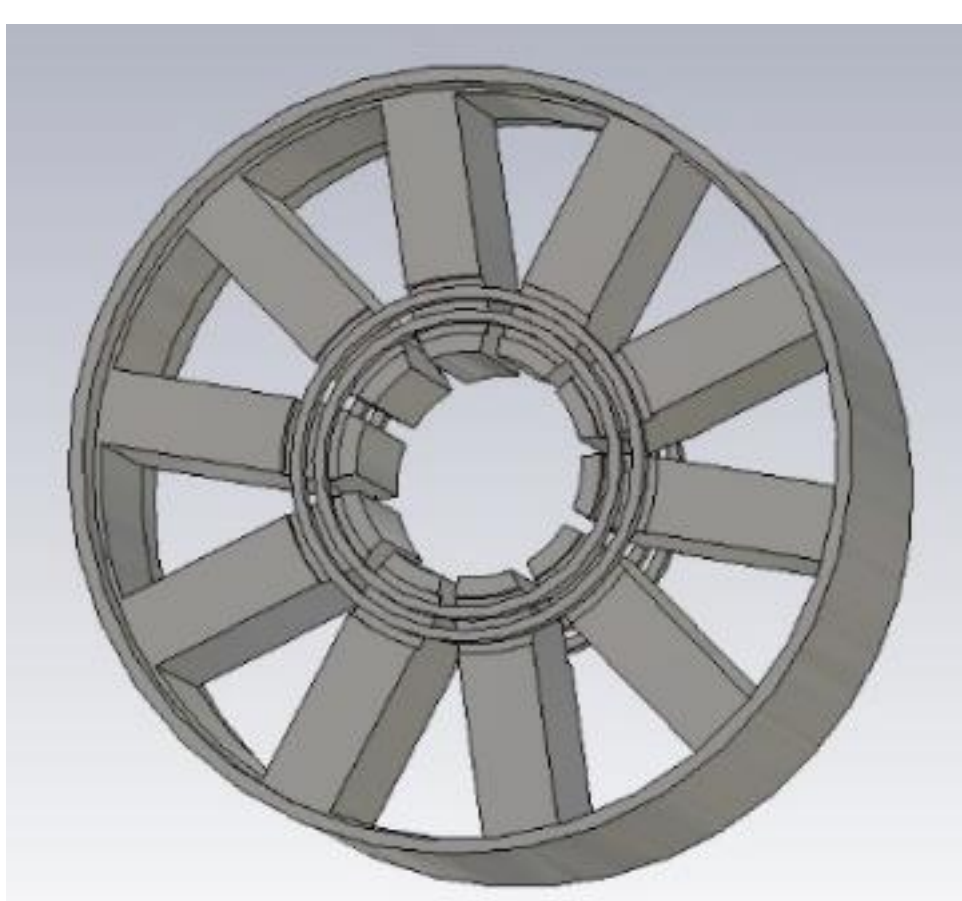


S11 of the output structure

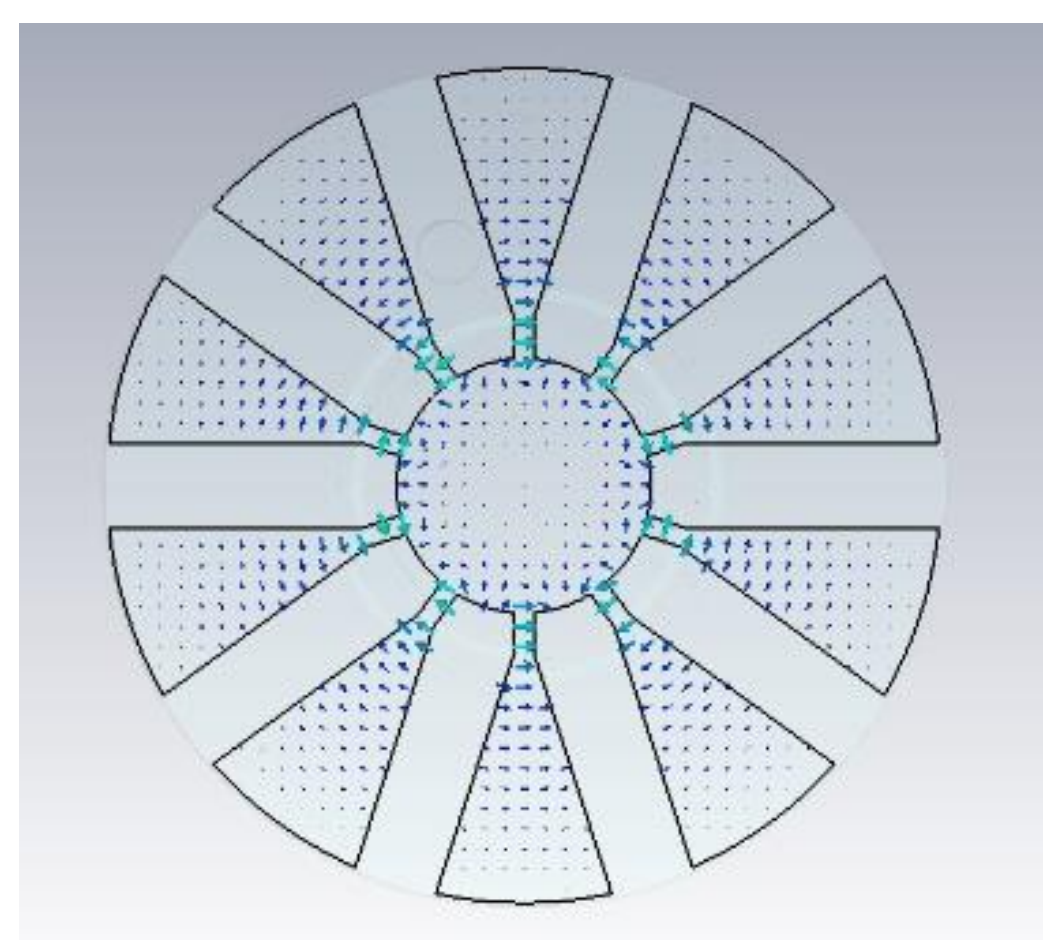


The finished cavity and output antenna

2.2 Cavity and output structure design

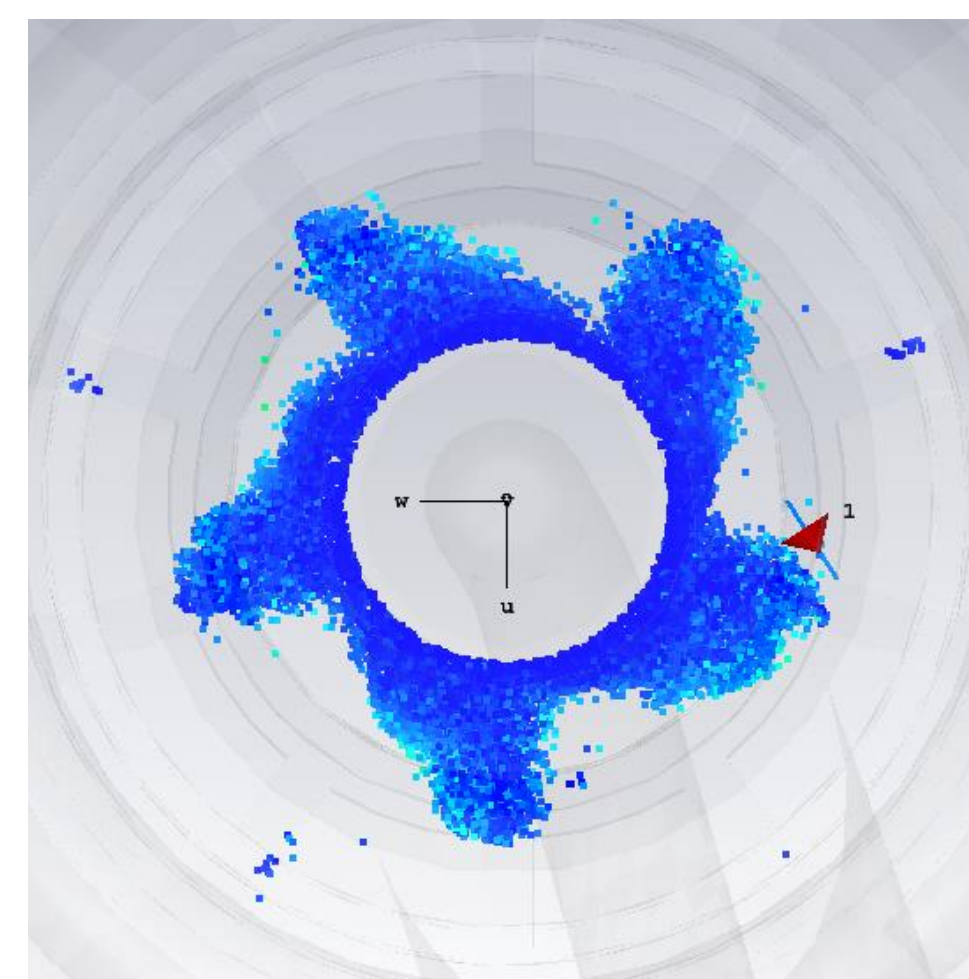


The simulation model

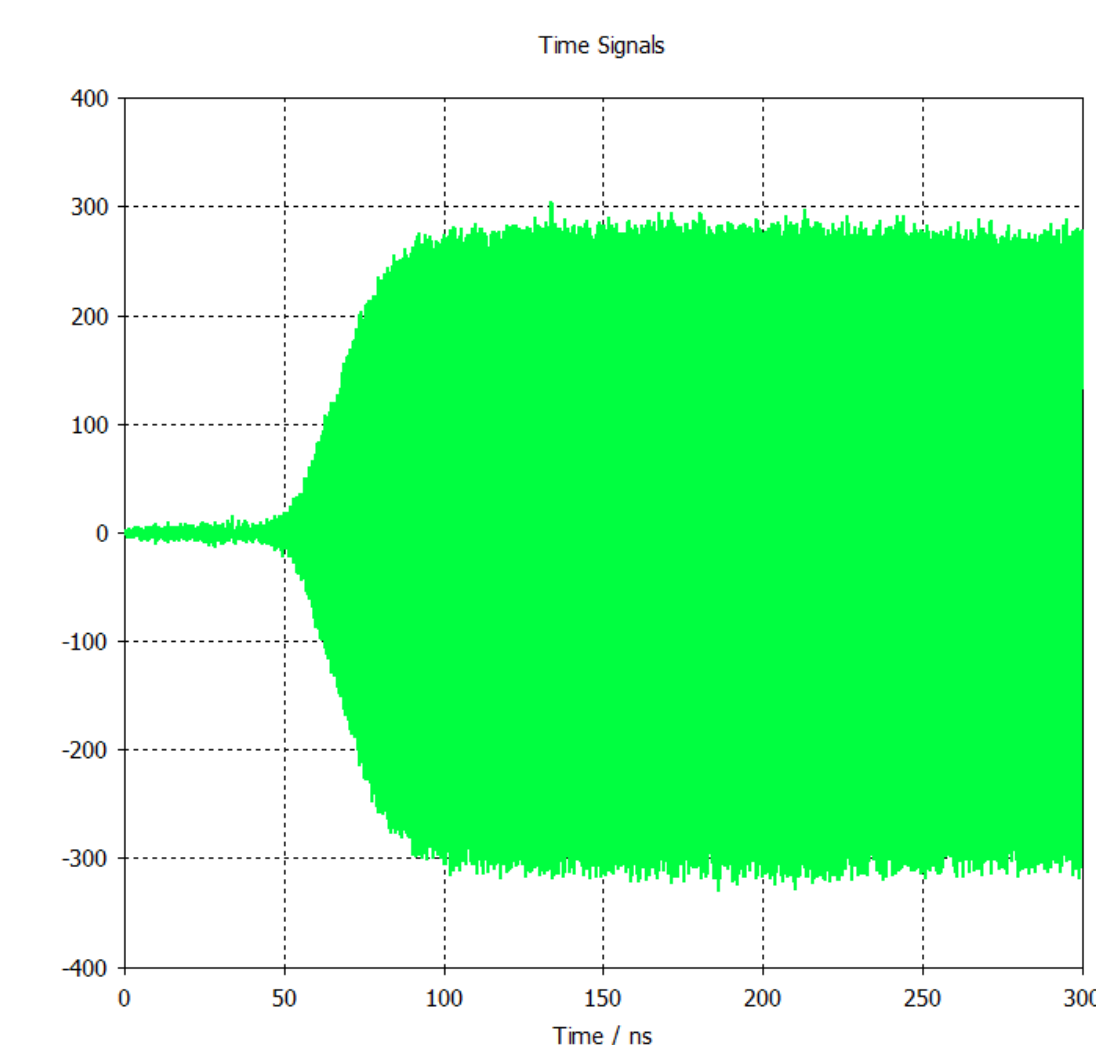


The electric field distribution of the n mode

2.3 Whole magnetron simulation



The electron distribution in the interaction space



The output signal of the magnetron

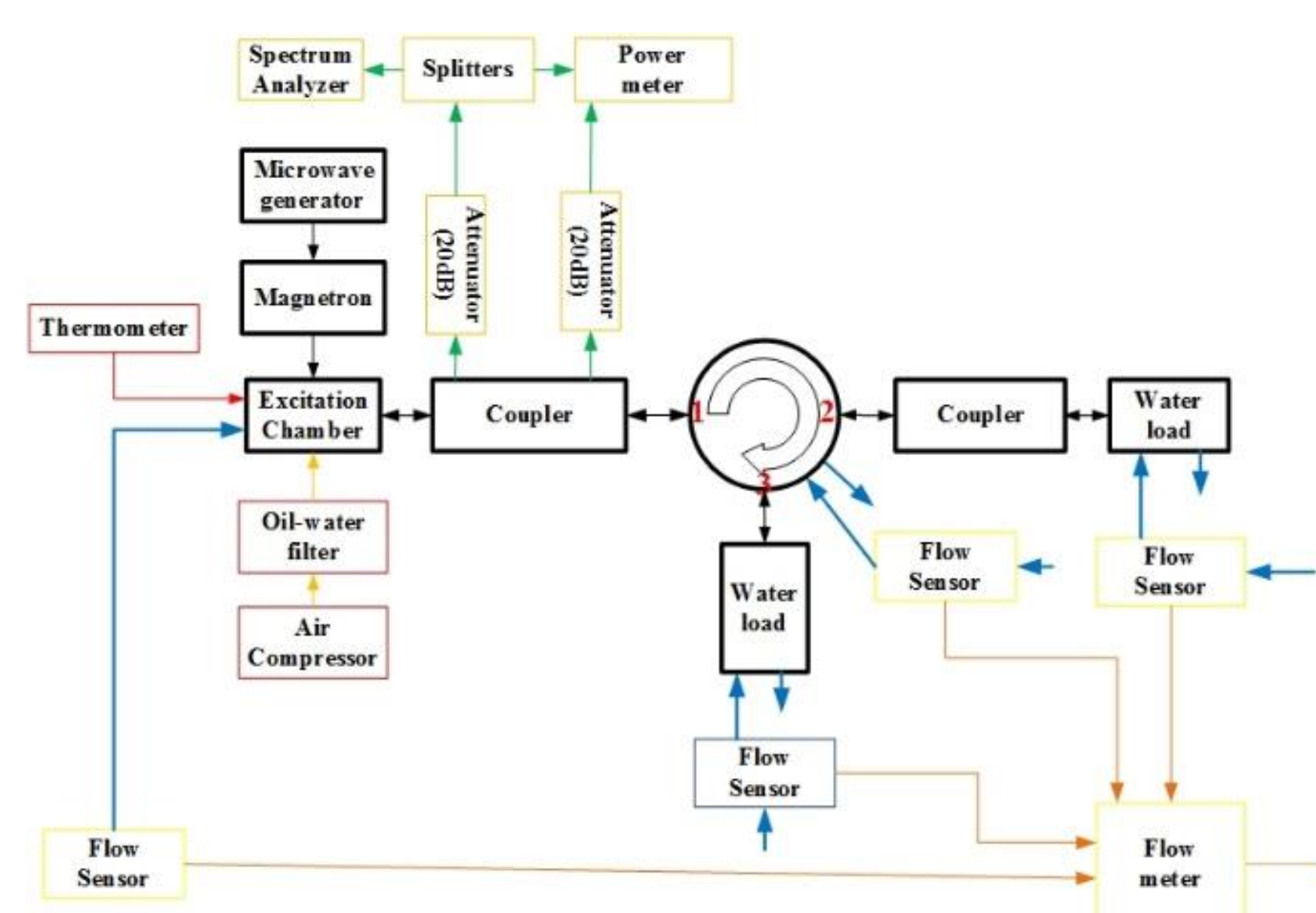
3. Testing system and products



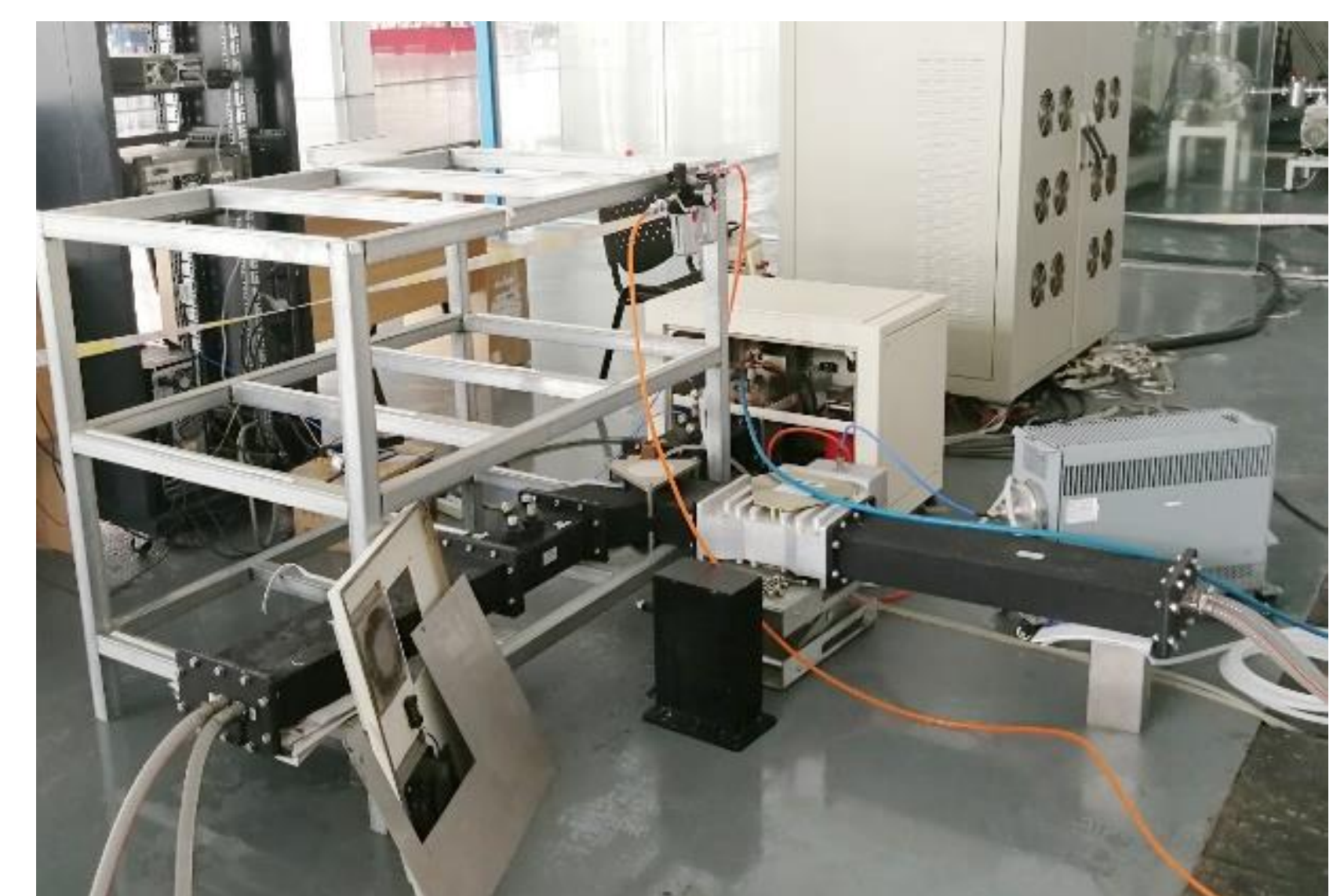
The excitation chamber



The prototype of 1.5GHz CW magnetron

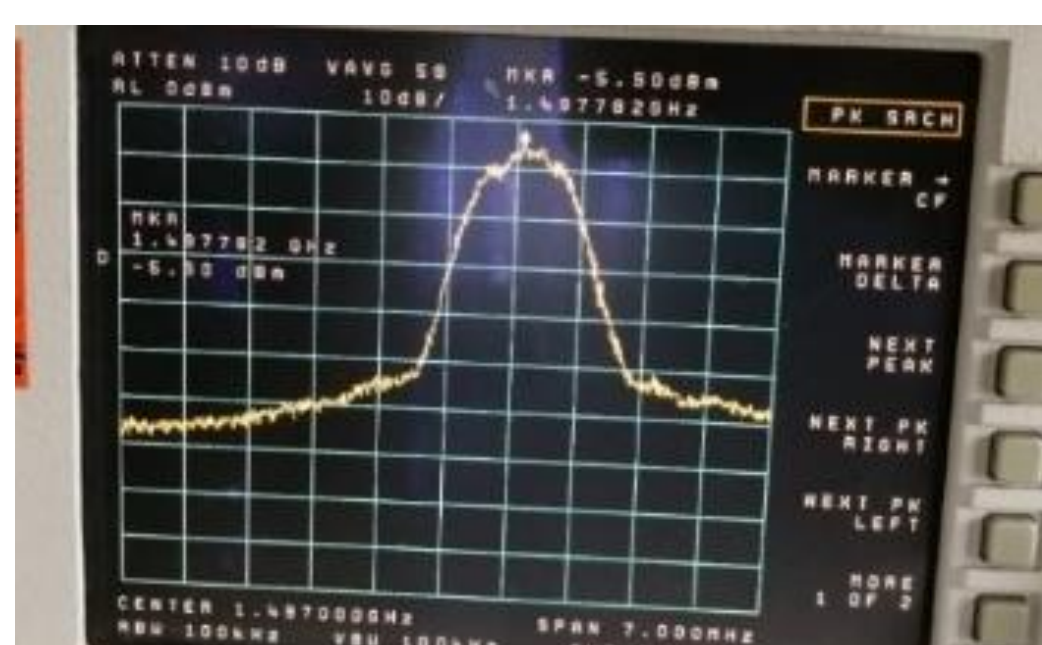


The schematic diagram of the power test of the magnetron



The test platform of magnetron

4. Testing results



Testing results of 1.5GHz CW magnetron



5. Conclusions

A 1.5GHz high-power CW magnetron for SRF accelerator is successfully developed by Andesun Technology Group Co., Ltd. with Nanjing Sanle Electronic Information Industry Group Co., Ltd. The test results show that the 1.5GHz magnetron meets the design requirements and can meet the application requirements of SRF accelerator.