

# Design and high power test of 650MHz/800 kW high efficiency klystron for CEPC



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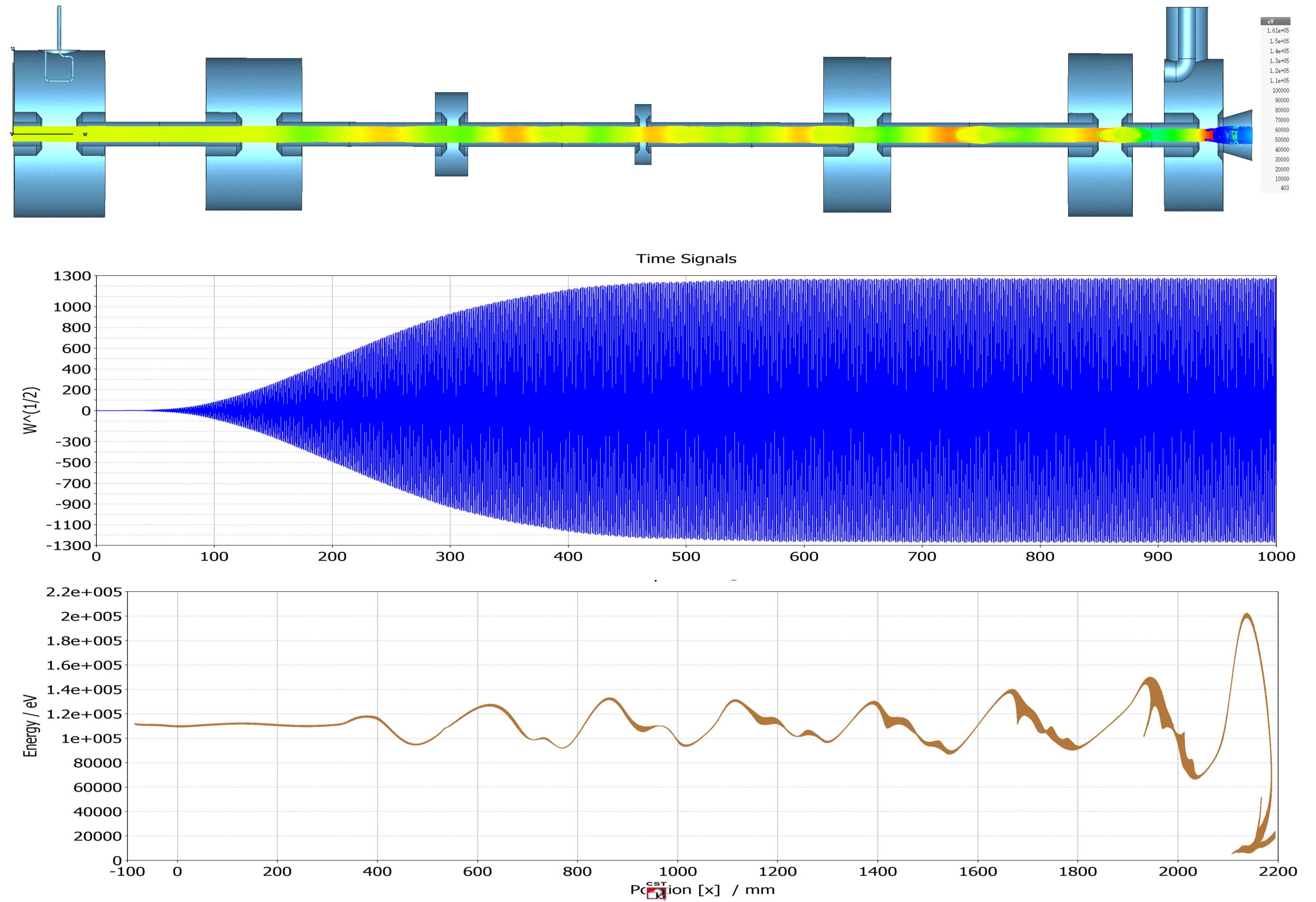
## Introduction

To reduce energy consumption and operating cost for circular electron positron collider (CEPC) in China, the high efficiency klystron are being developed as a priority frontier technology at Institute of High Energy Physics, Chinese Academy of Sciences. A high efficiency 800 kW continuous wave klystron operating at frequency of 650 MHz, using a low perveance (0.25  $\mu\text{P}$ ) and a novel bunching method(CSM), has been successfully developed. The full 3-dimensional particle-in-cell simulation of the whole klystron in CST verified that the klystron efficiency was achieved up to 77% without instability and returning electrons. This prototype klystron has been finished high power acceptance test in August 2024. The test results show that the output power and efficiency have reached 803kW and 78%, respectively.

## High efficiency klystron design

Klystron main design parameters

Parameters	Value
Operating frequency	650 MHz
Beam Voltage	113 kV
Beam Current	9.5 A
Beam Perveance	0.25 $\mu\text{A}/\text{V}^{3/2}$
Efficiency at rated Output Power	$\geq 75\%$
Saturation Gain	$\geq 43$ dB
Output power	800 kW
1 dB Bandwidth	$\pm 0.5$ MHz
Brillouin Magnetic Field	116 Gs
Number of Cavities	7



3D simulation results in CST

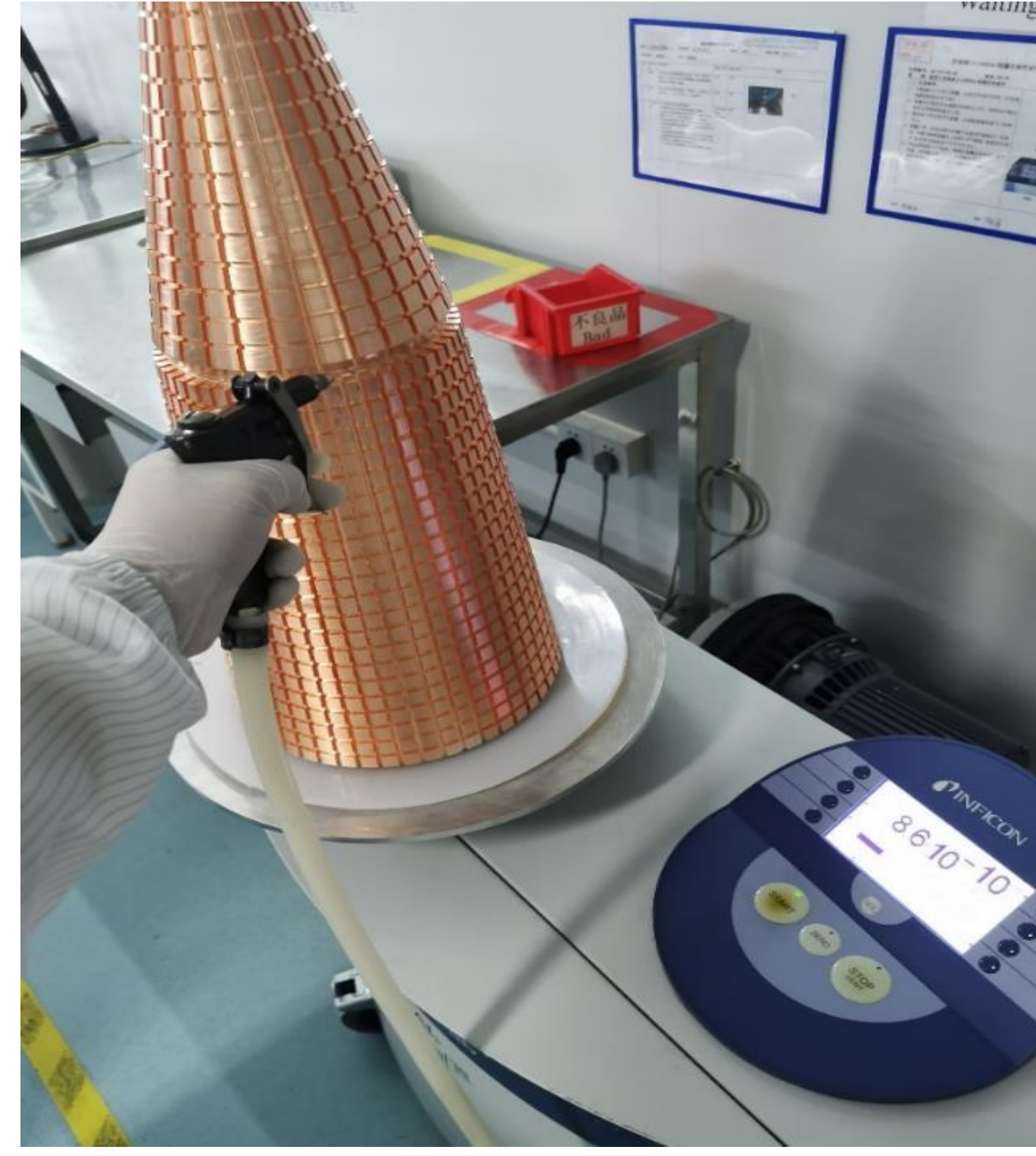
## High efficiency klystron components manufacture



Gun



Cavity

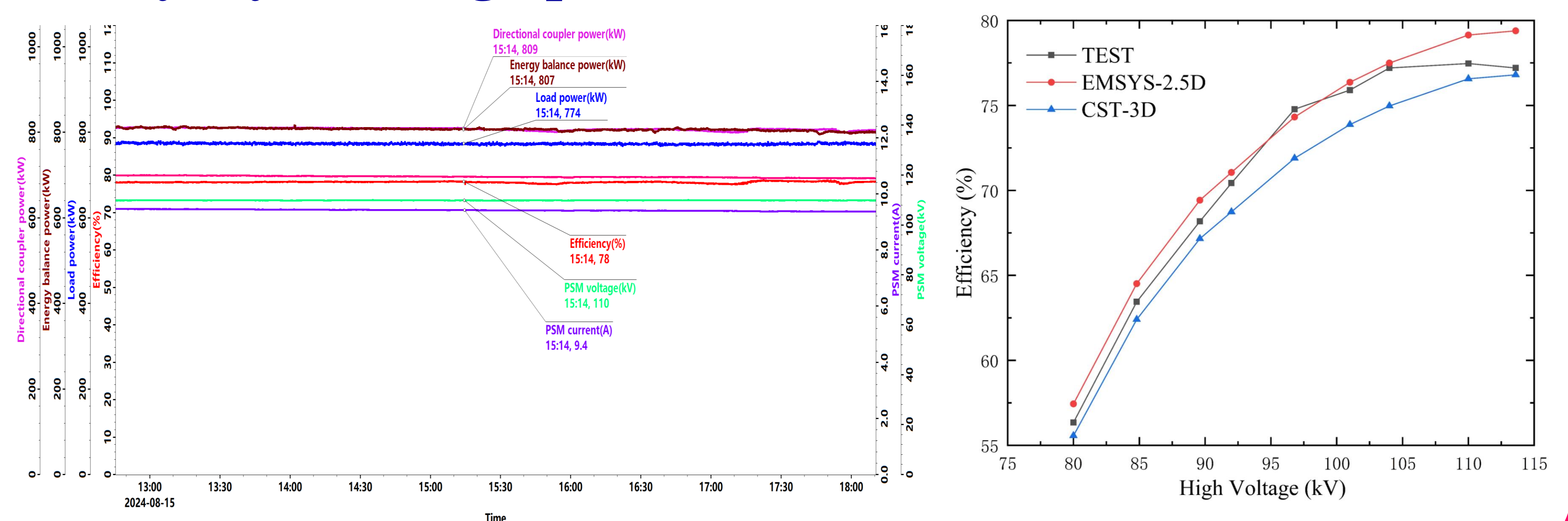


Collector



Coil

## High efficiency klystron high power test



## Acknowledgment

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