Study on Microwave Sulfur Lamp

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The microwave sulfur lamp is electrodeless light sources discharged by microwave. It has high efficiency, long lifetime and the closest spectrum to the sun of any artificial light sources.

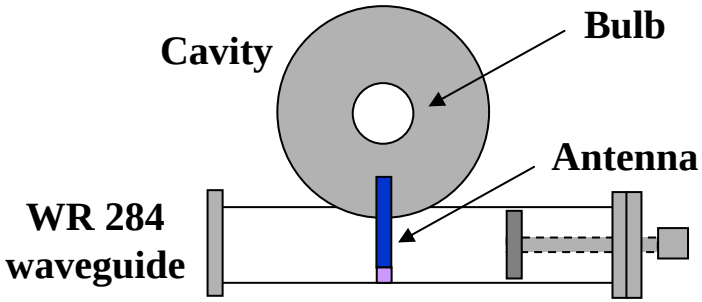
In this experiment, we study the emission spectrum according to input microwave power by magnetron and microwave breakdown data in various condition. For this work, we design the coupling structure.

Introduction

- Microwave breakdown is the occurrence of an event where the electron density reaches such high values that the wave propagation properties of the considered electrodynamic structure became significantly changed.

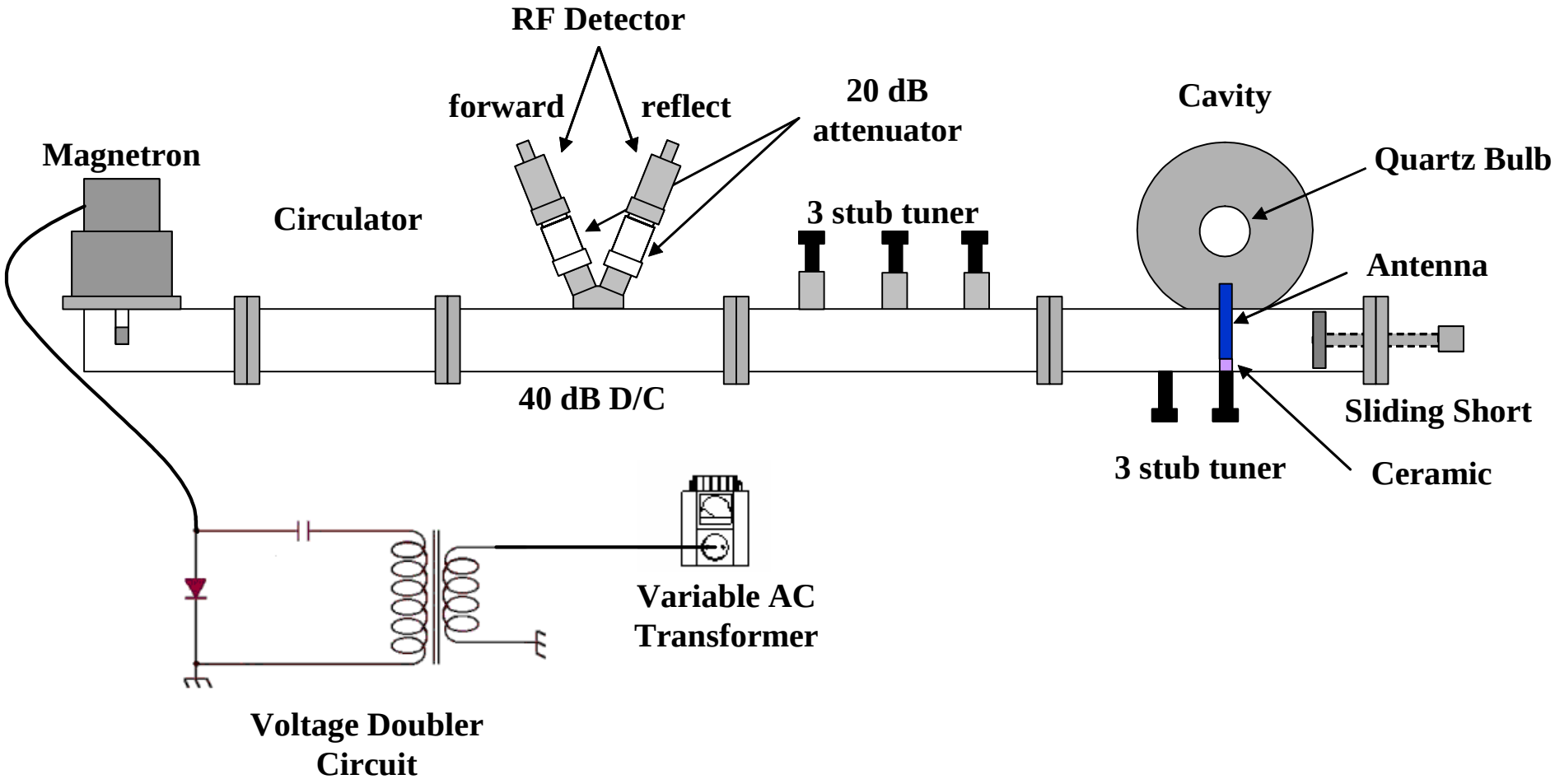
$$n(t) \geq n_H$$

- We design the floating antenna coupling structure between cavity and waveguide.



- The Breakdown power was measured by the RF detector (forward power – reflected power)
- The measured power was converted to the electric field intensity using HFSS

Experiment Setup



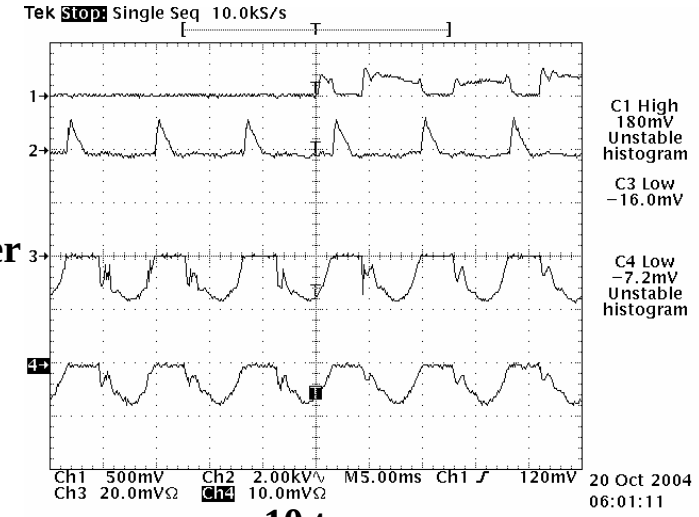
Output signal

Ch.1 PhotoTR

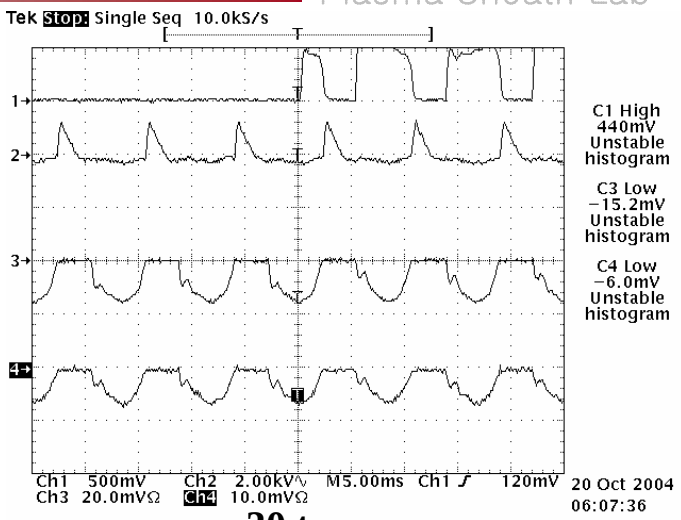
Ch.2 H.V.

Ch.3 forward power

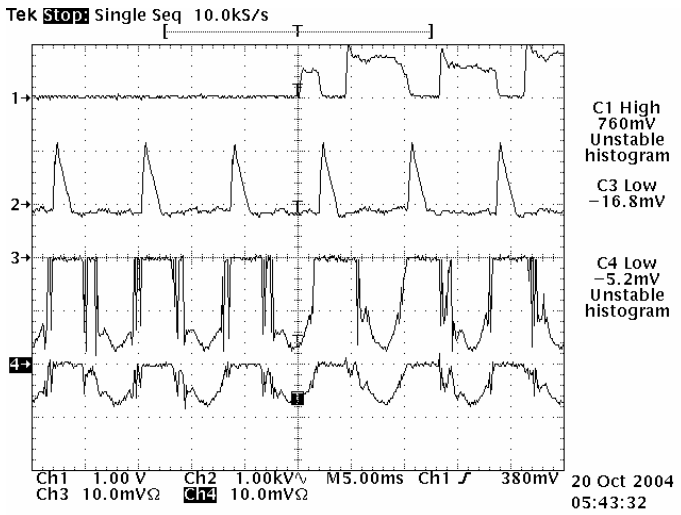
Ch.4 reflect power



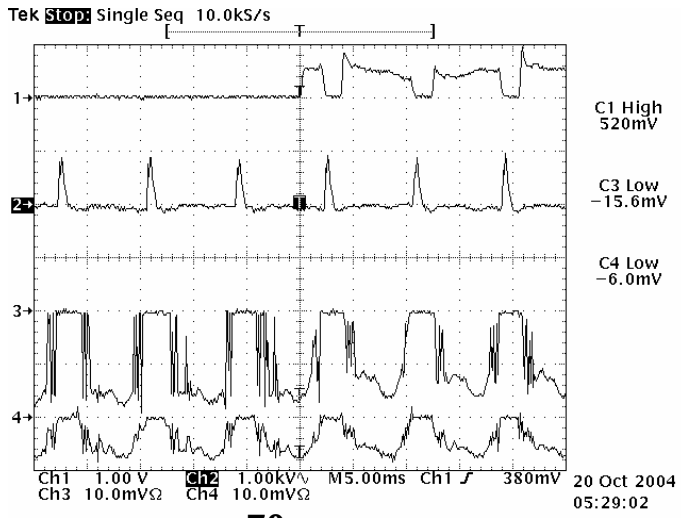
10 torr



30 torr

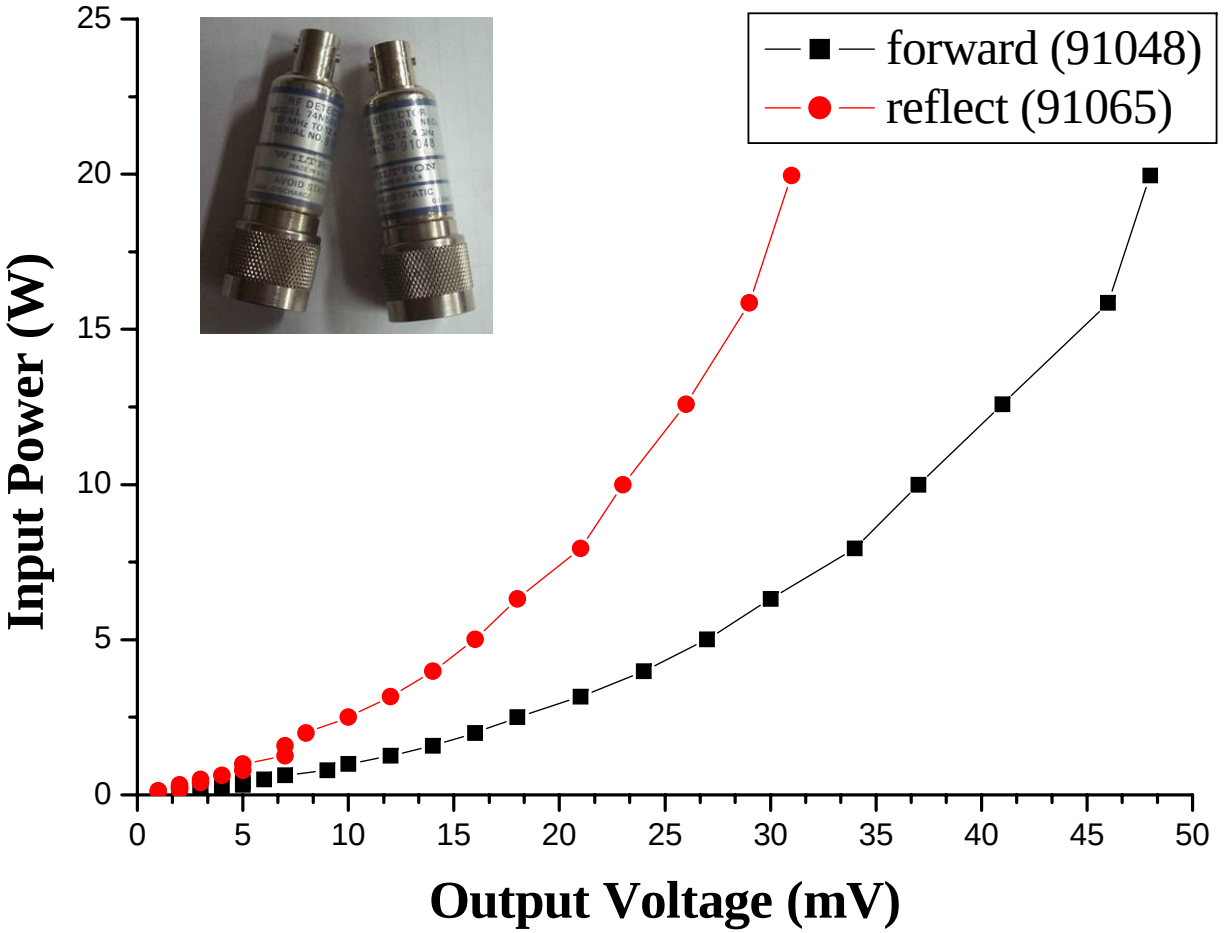


50 torr

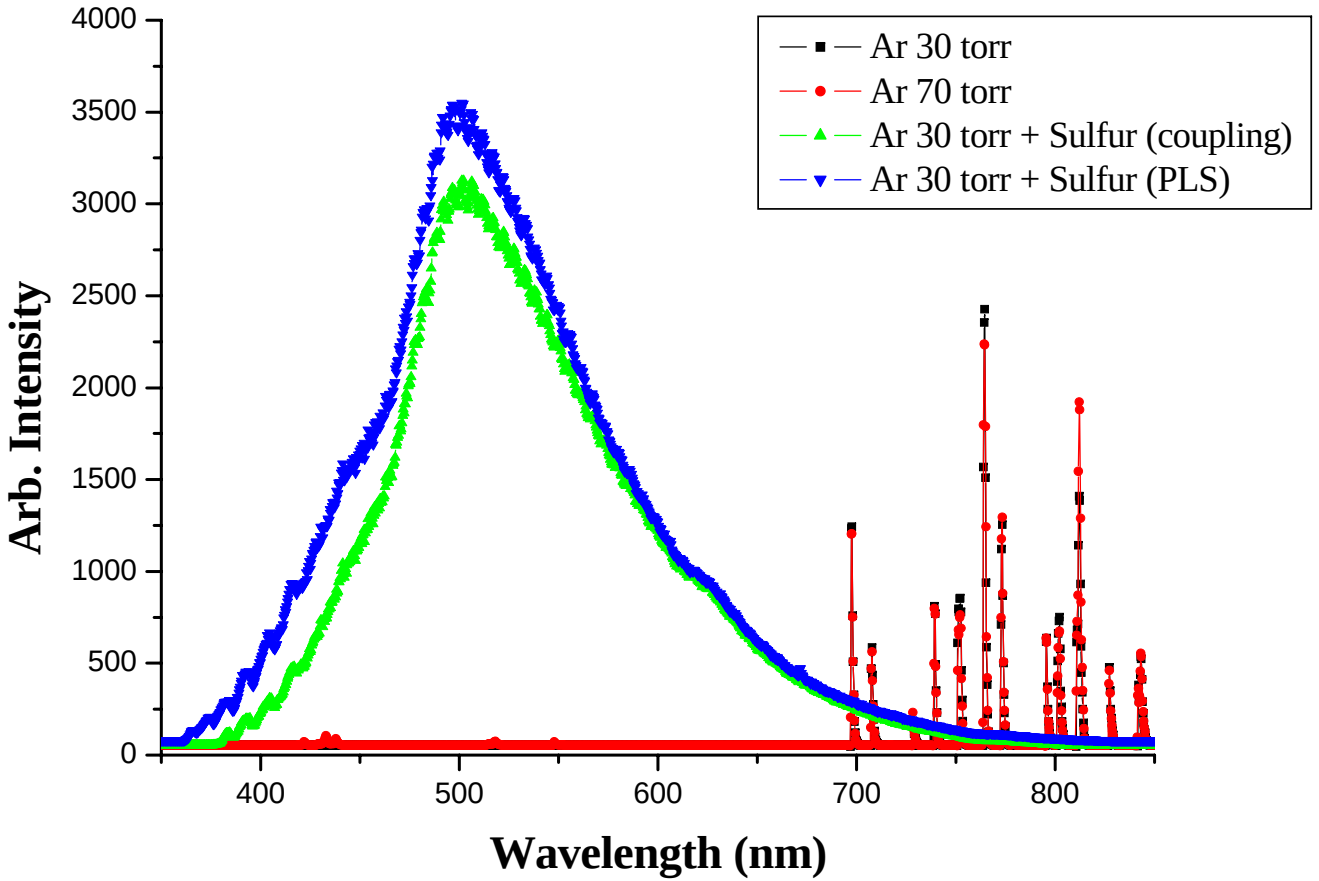


70 torr

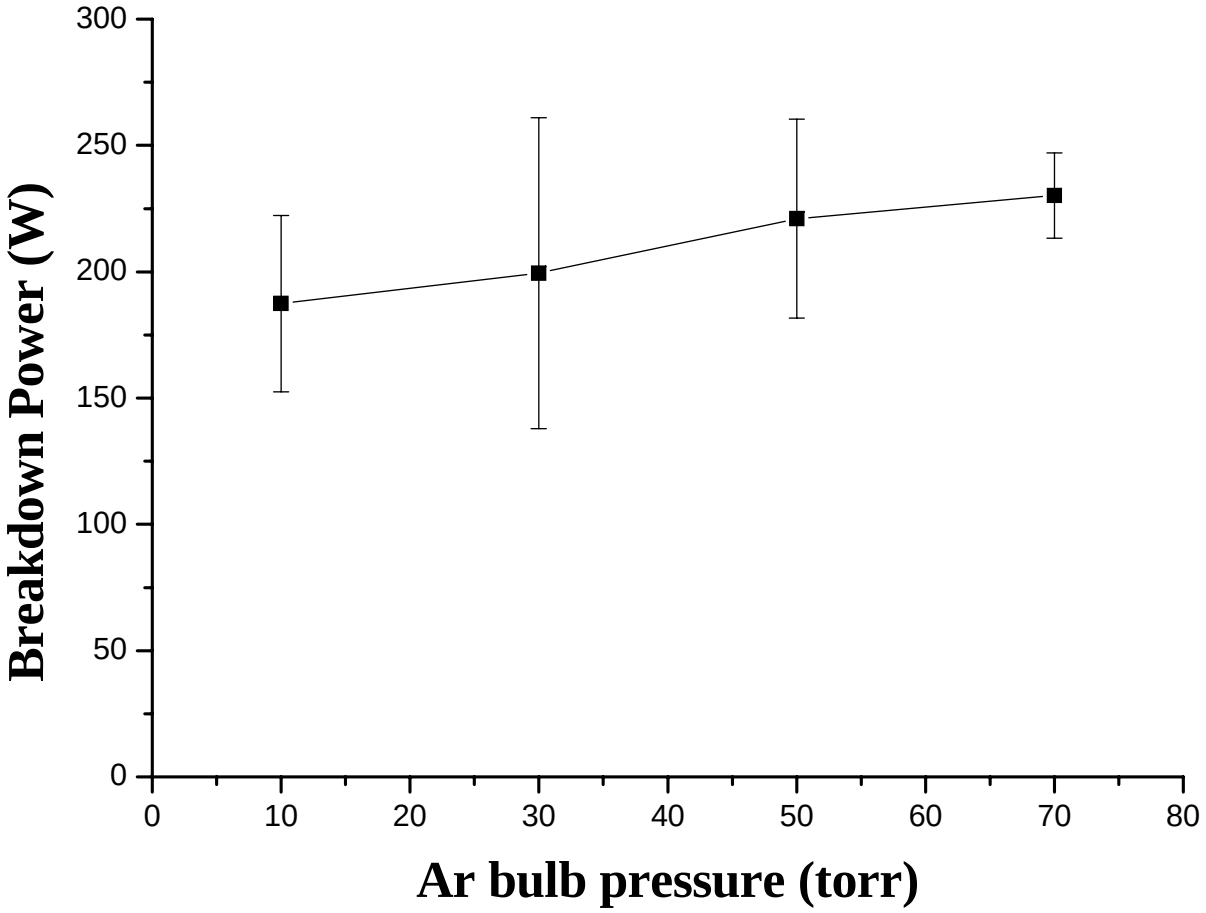
RF Detector Sensitivity Curve



Ar Emission spectrum



Cavity Discharge Breakdown



Cavity Discharge Breakdown by simulation

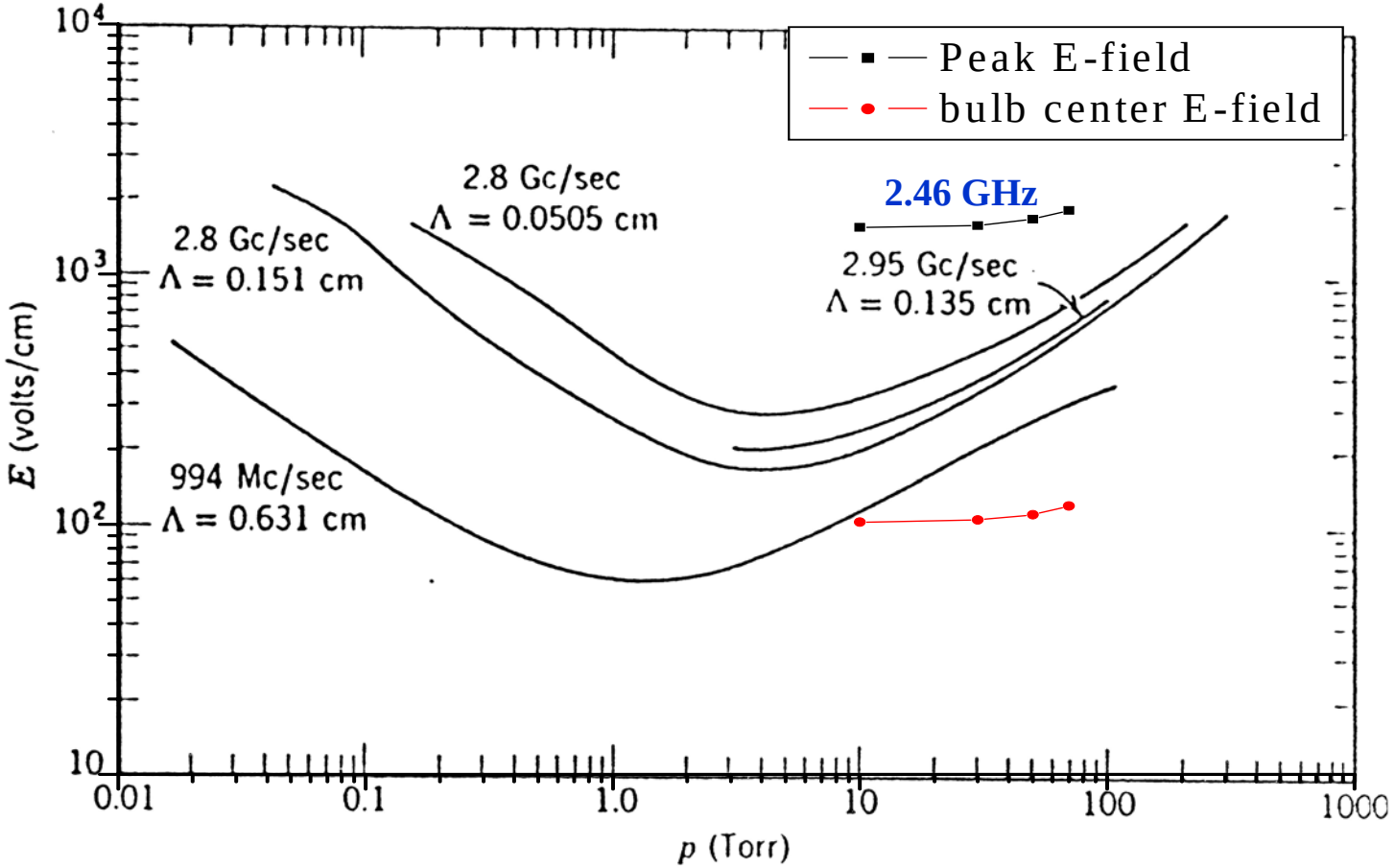


Figure 5-9 Breakdown electric fields in argon.

Summary

- We designed the floating antenna coupling structure between cavity and waveguide.
- We measured breakdown power in microwave discharge in various pressure ranges.
- The associated electric field strength for the measured RF breakdown power was found using HFSS simulation

Reference

- A.D. MacDonal, *Microwave Breakdown In gases*, John Wiley & Sons, New York, 1966
- Ulf Jordan, *Microwave Breakdown Physics and Applications*, 2002
- http://people.cornell.edu/pages/bs79/BM_r1.htm