# Design and construction of a microwave cavity.

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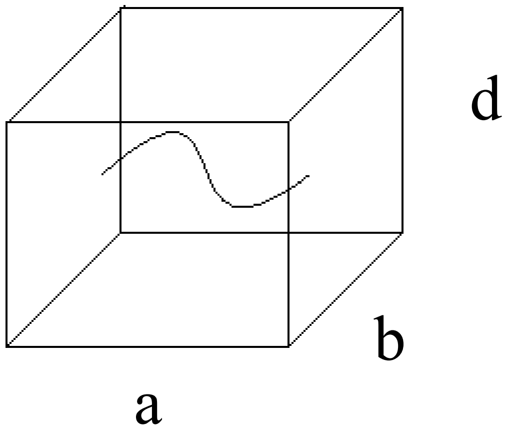
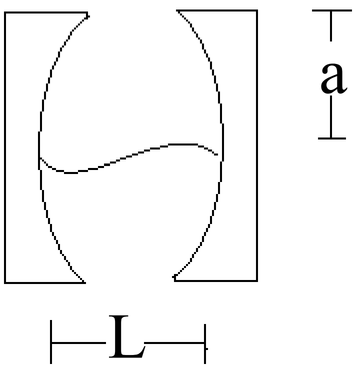
# Examples of microwaves cavities




closed




Open Fabry Perot

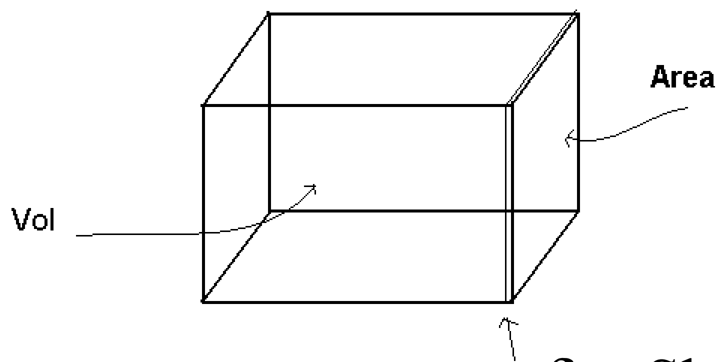
Resonant frequency

$$f = \frac{c}{2}\sqrt{\left(\frac{m}{a}\right)^2 + \left(\frac{n}{b}\right)^2 + \left(\frac{p}{d}\right)^2}$$

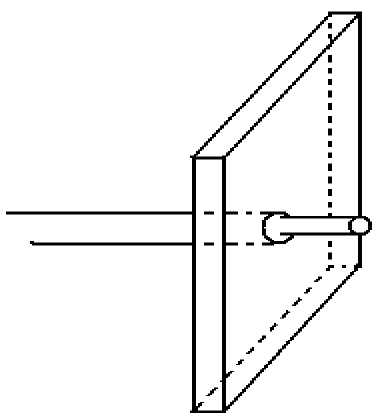
Resonant frequency

$$f = n\frac{c}{2L}$$

$$Q = \frac{f}{\Delta f} \approx \frac{Vol}{(area)\delta}$$

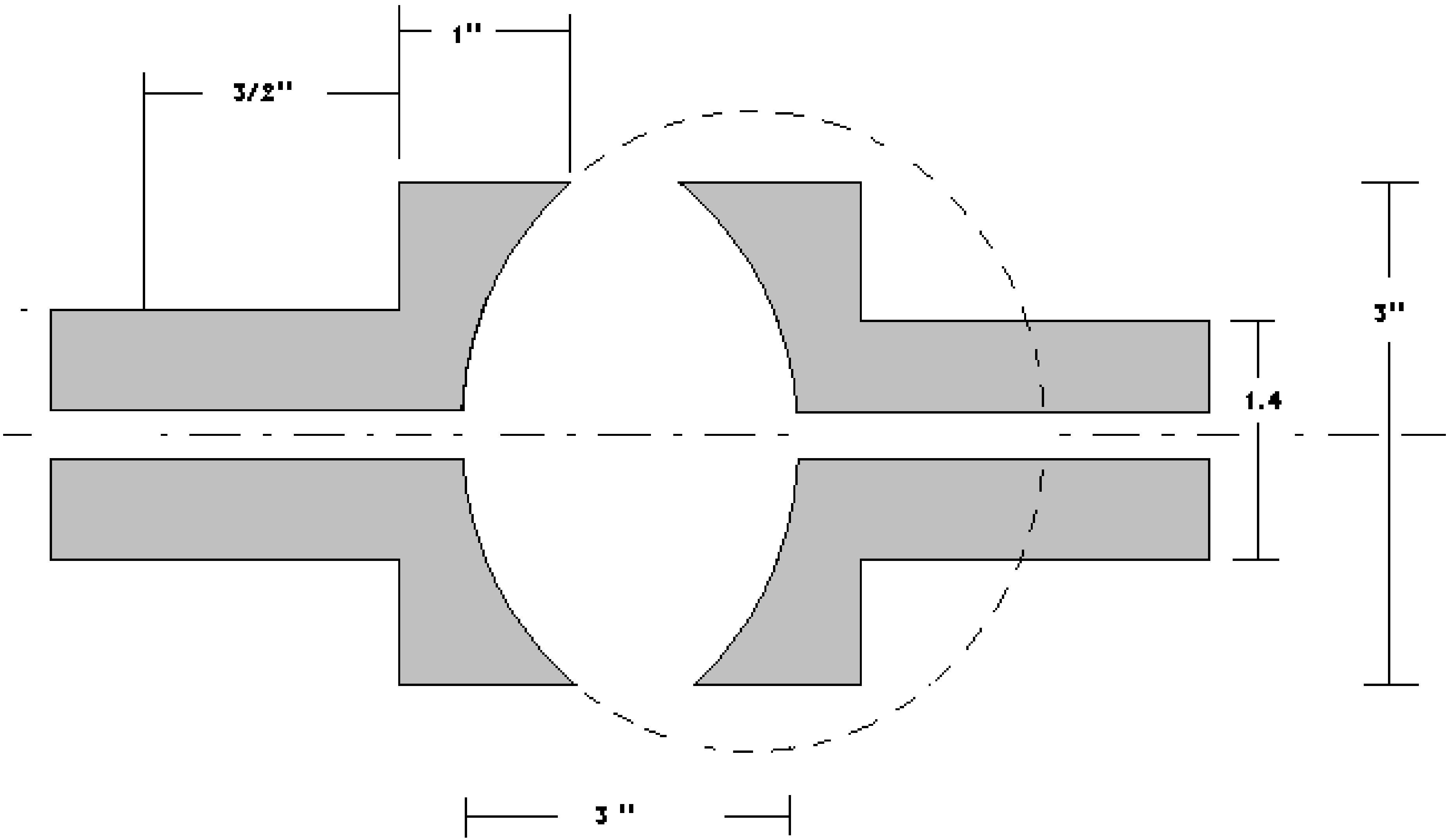



$\delta$ Skin depth



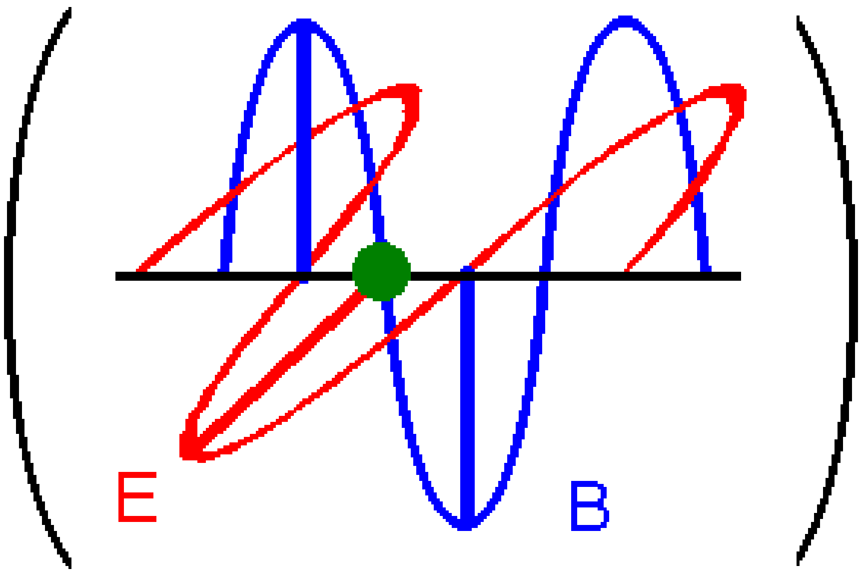
Coupling = antenna + receptor

CONFOCAL RESONATOR (Cross section view)




Curvature radius of mirrors

# The cavity will be used in Francium spectroscopy



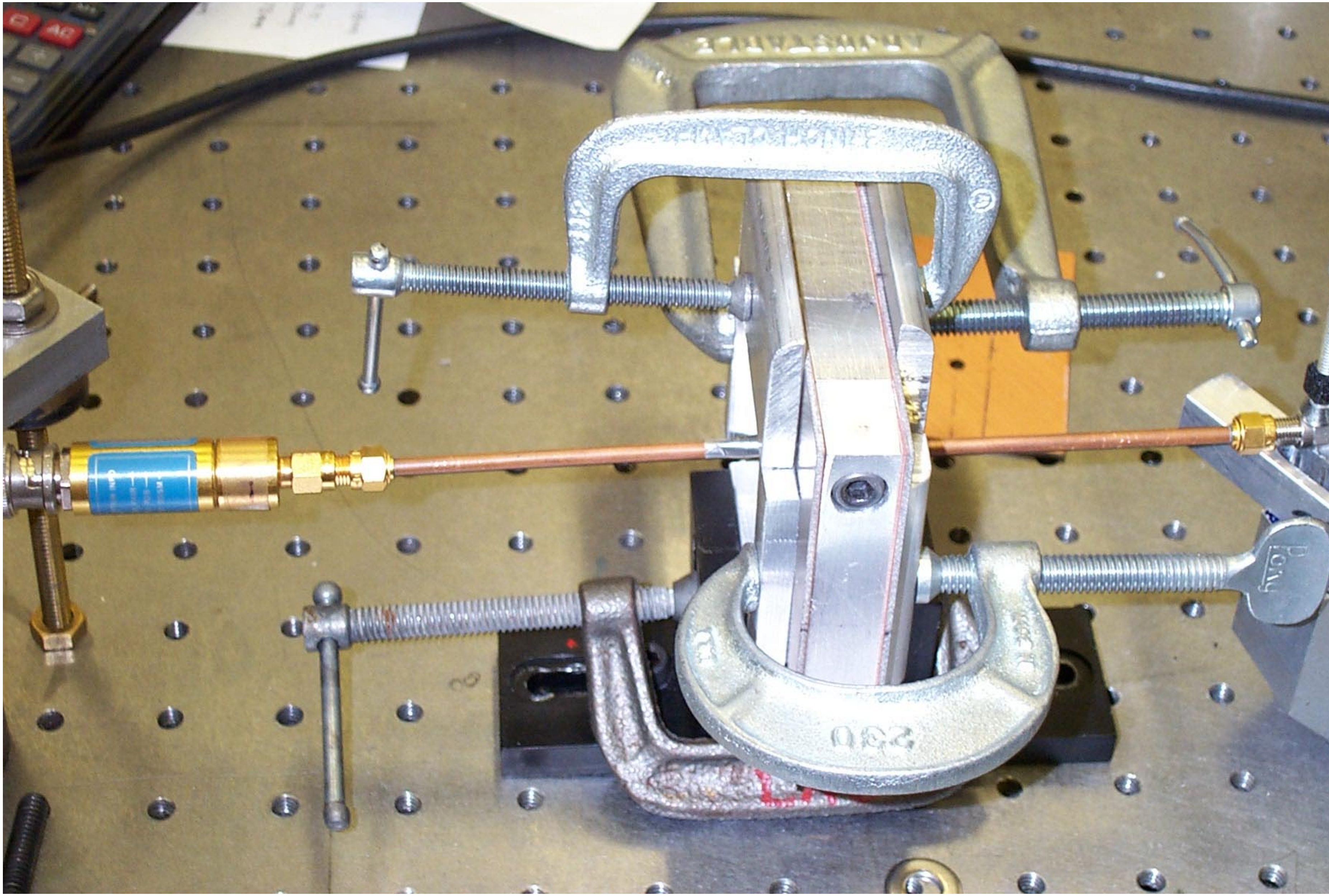

$^{211}$Fr, I=11/2

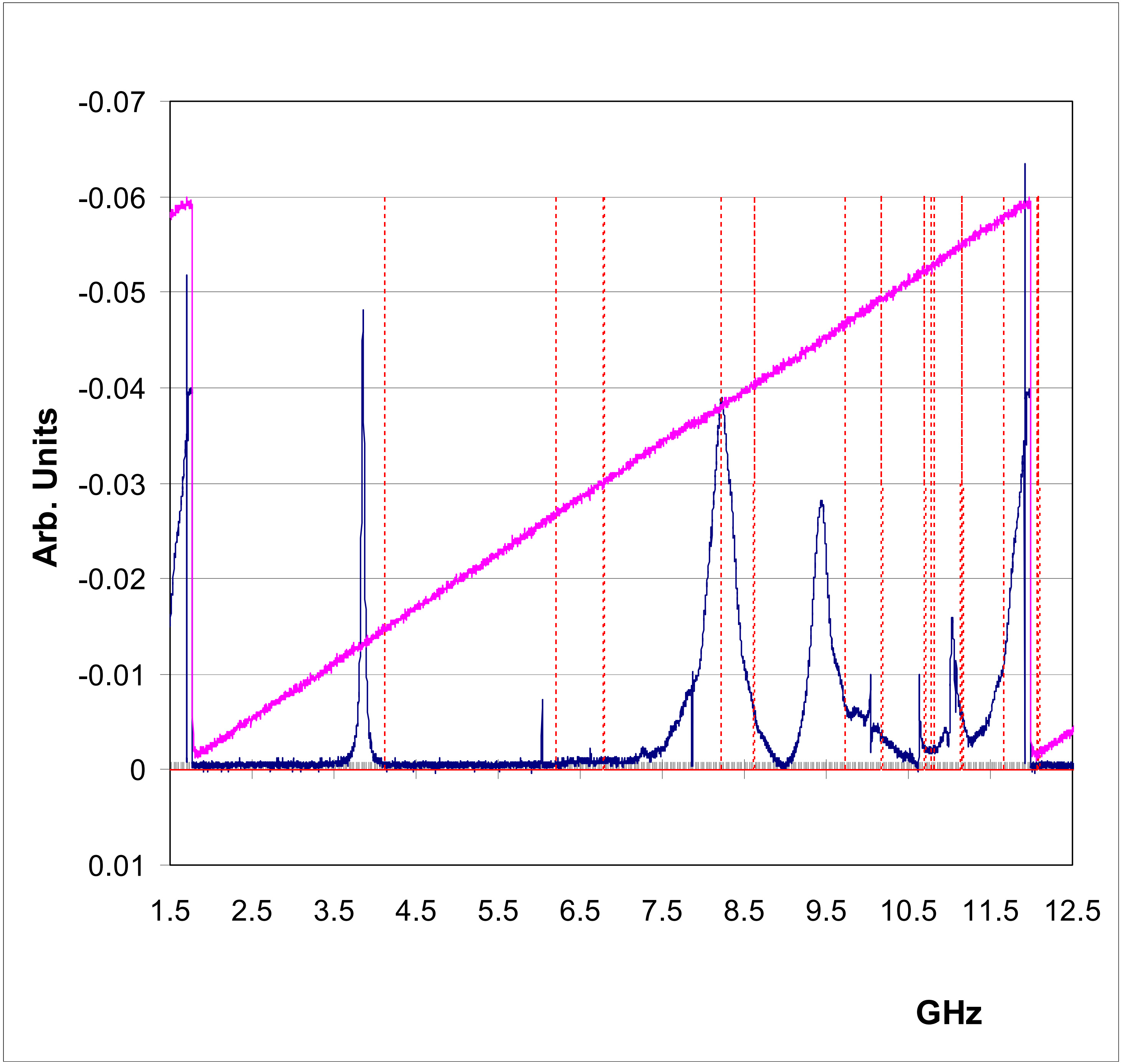
$7S_{1/2}$

F=6

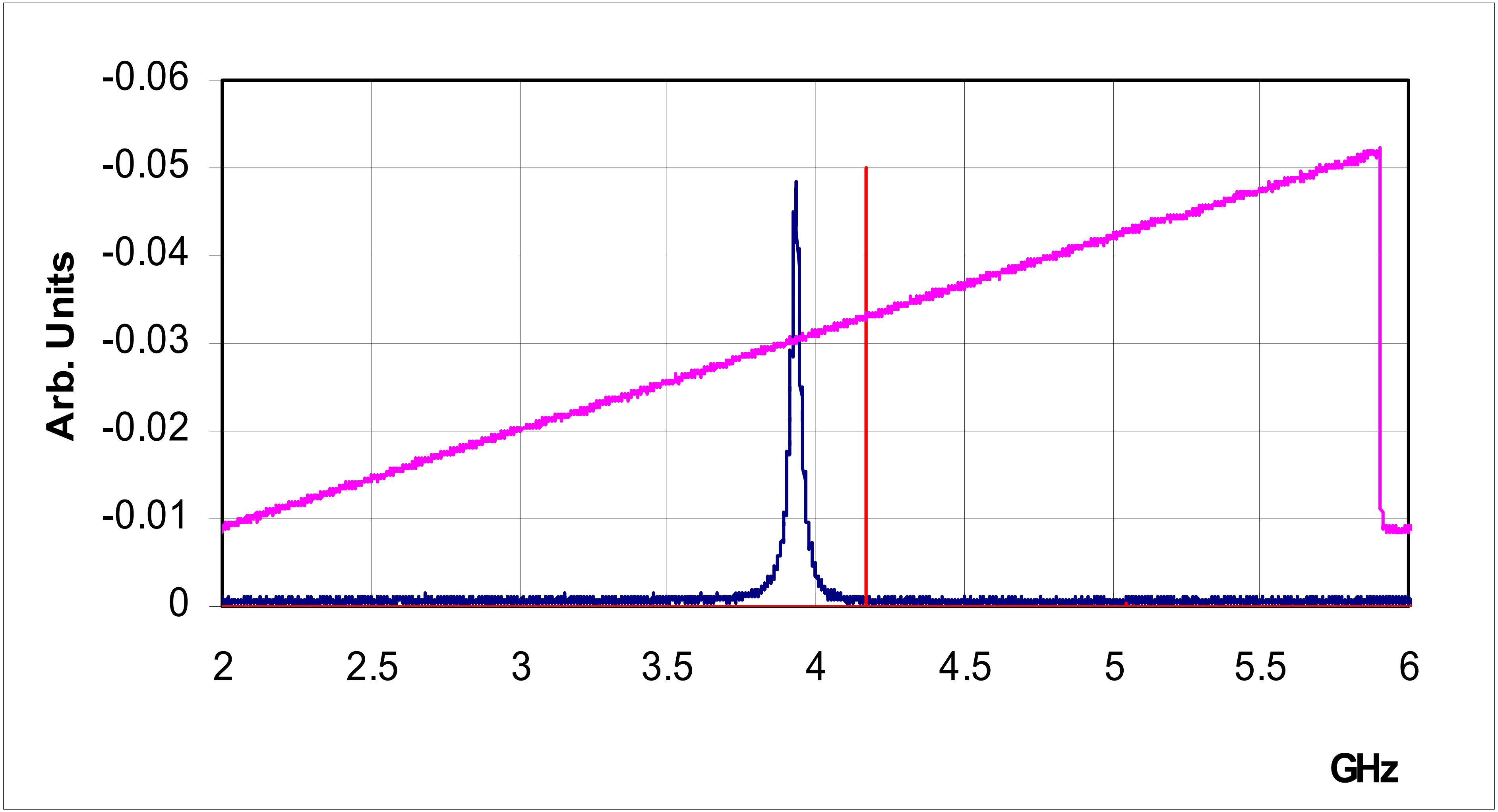
46 GHz

F=5



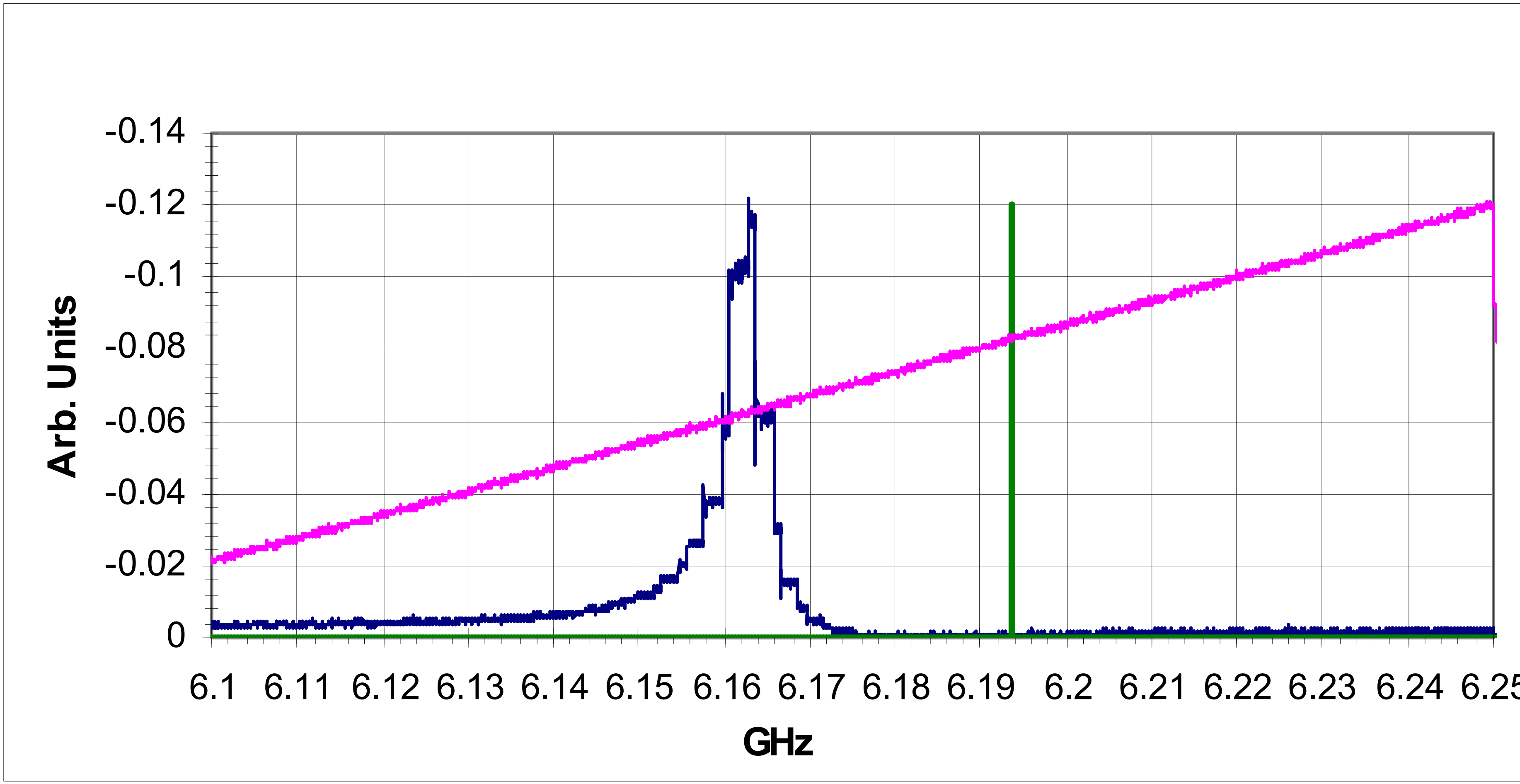


-0.07
-0.06
-0.05
-0.04
-0.03
-0.02
-0.01
0
0.01
Arb. Units
1.5
2.5
3.5
4.5
5.5
6.5
7.5
8.5
9.5
10.5
11.5
12.5
GHz

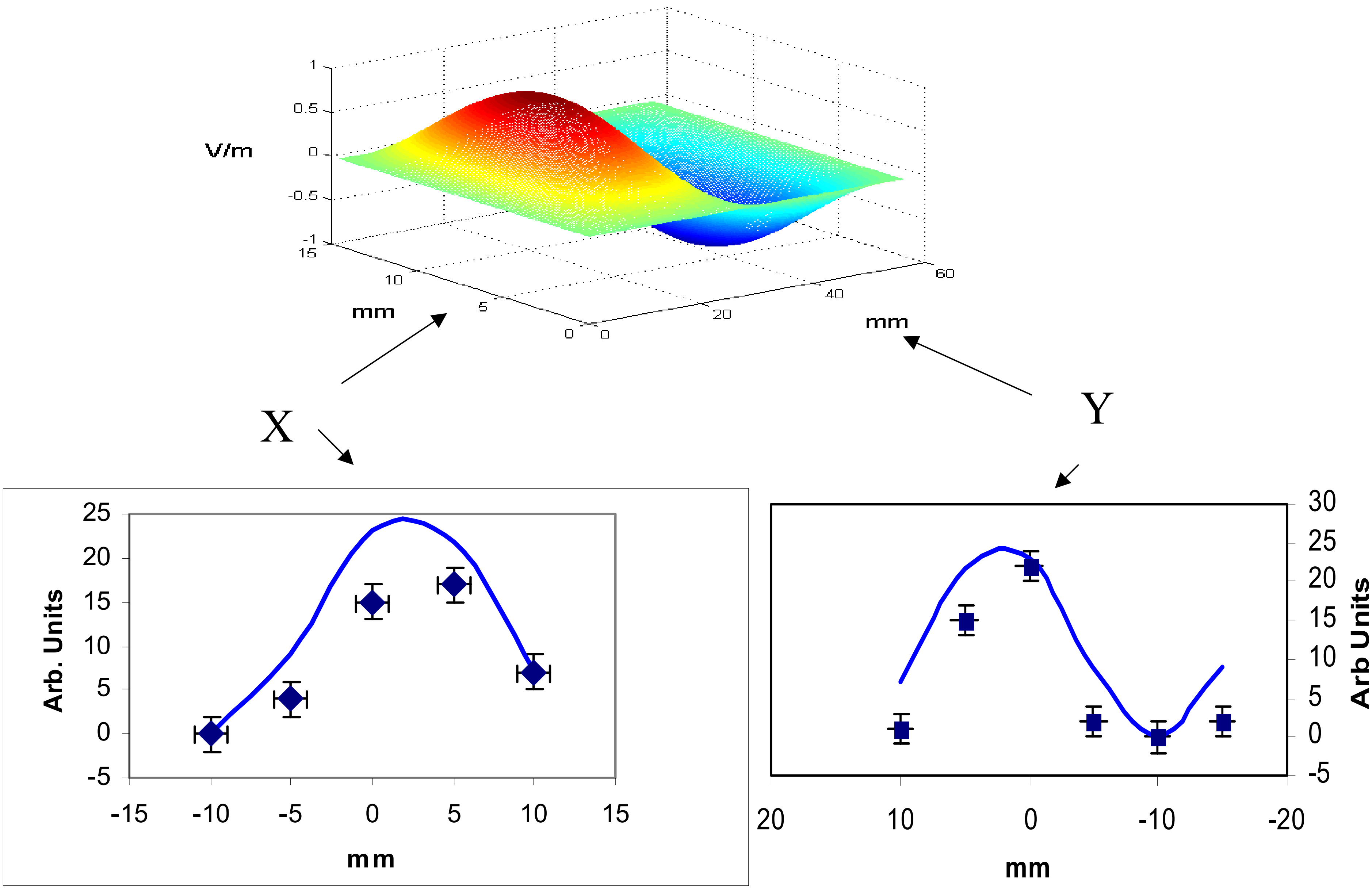


-0.06
-0.05
-0.04
-0.03
-0.02
-0.01
0
Arb. Units
2
2.5
3
3.5
4
4.5
5
5.5
6
GHz

# The highest Q peak is the TE 102 mode



# Structure of the TE 102 mode



# Conclusions

- We designed a Fabry Perot microwave cavity.
- We constructed a test cavity and studied its mode structure and Q factor.
- We understood the first modes of the spectrum and improved their Q factor, for the TEM 102 at 6.16 GHz $Q=1541 \pm 750$

We would like to thank Corie Vaa for her help in this project.

Excitation of modes is introduced by an antenna that drives microwaves from a Gigatronics generator. The receptor is a similar antenna connected to a diode. Both signals are viewed in an oscilloscope.