# Development of High resolution Cavity BPM

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# 1.Purpose of low power model

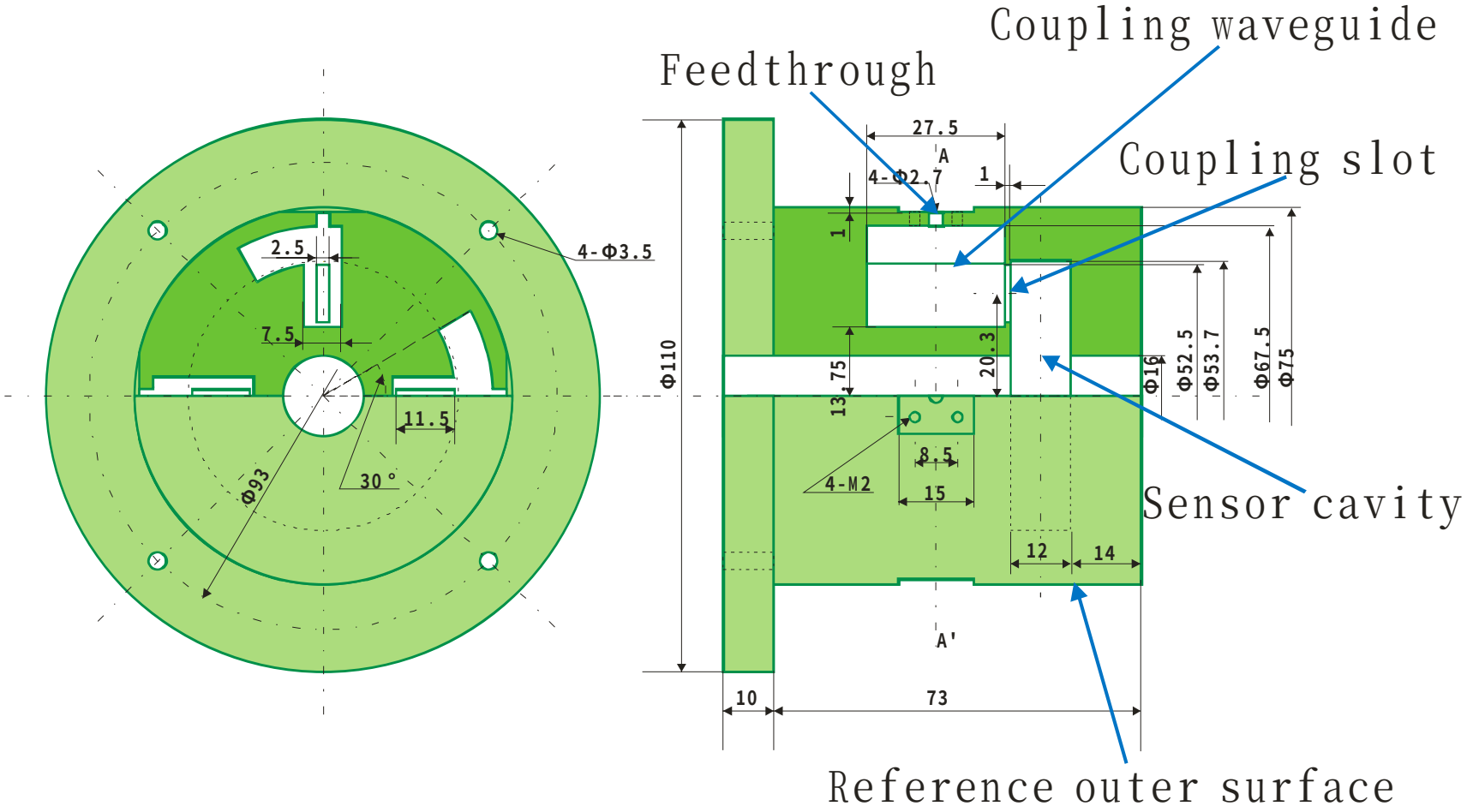
・Precision measurement of electrical center displacement from mechanical center.

・Goal;

・Confirm displacement < 10 $\mu$ m

Good initial alignment allows high resolution operation of electronics with enough dynamic range.

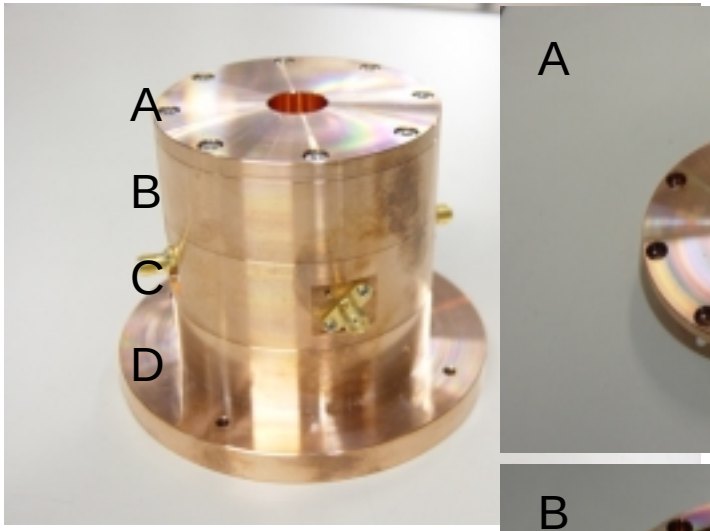
# 2.Sensor Cavity for precision measurement of mechanical center position

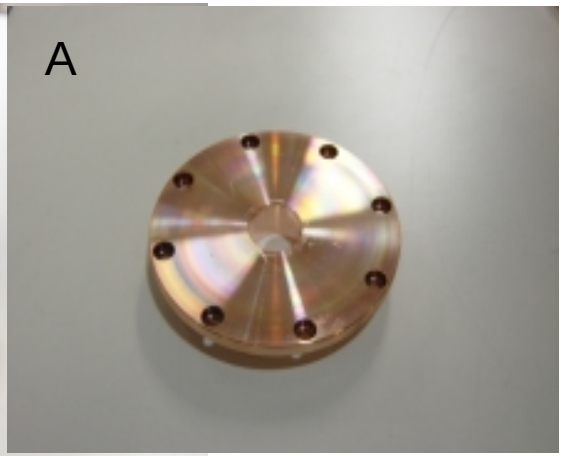


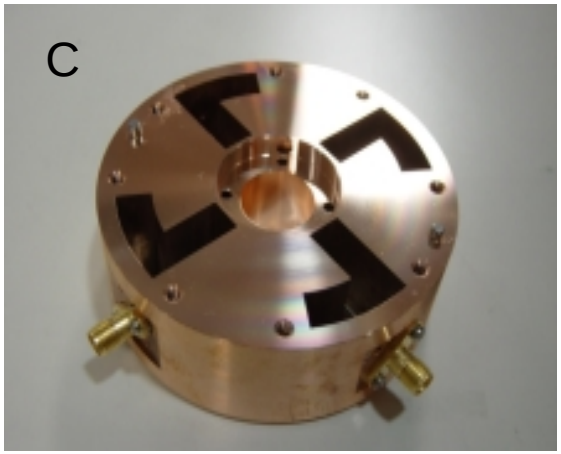
| Parameter | Value |
|---|---|
| Dipole frequency | 6.54GHz |
| Beam aperture diameter | 16mm |
| Cavity diameter | 53.7mm |
| Cavity depth | 12mm |

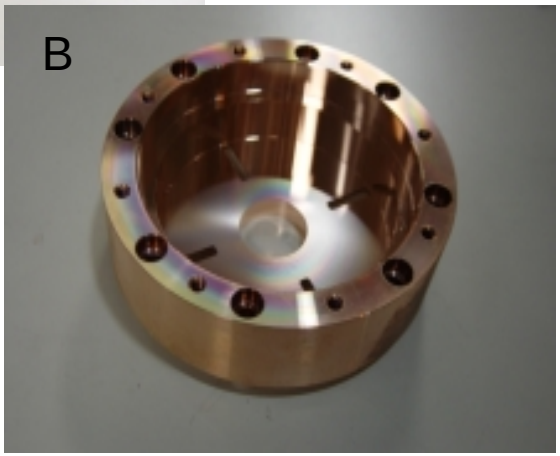
- Feature of Sensor Cavity
  - Cavity center coincide with body center.
  - Body surface is good reference surface.
  - Whole body is well fitted inside quadrupole magnet.

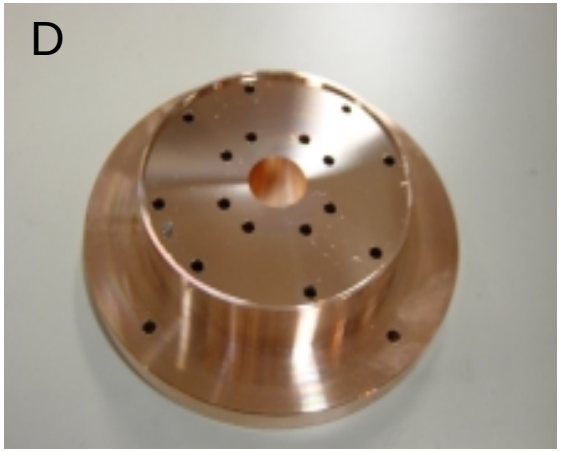
# ・Low power model of sensor cavity



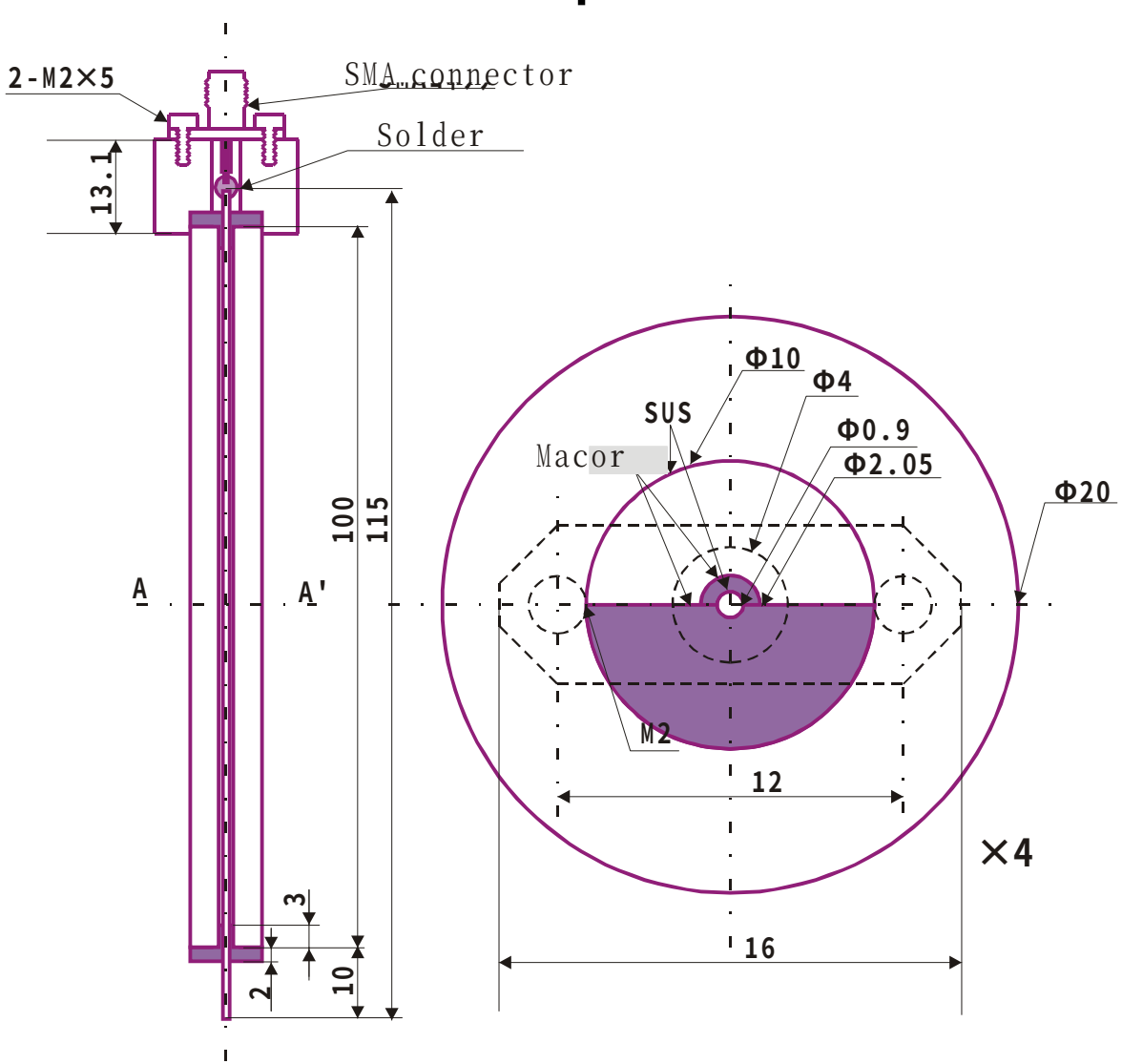



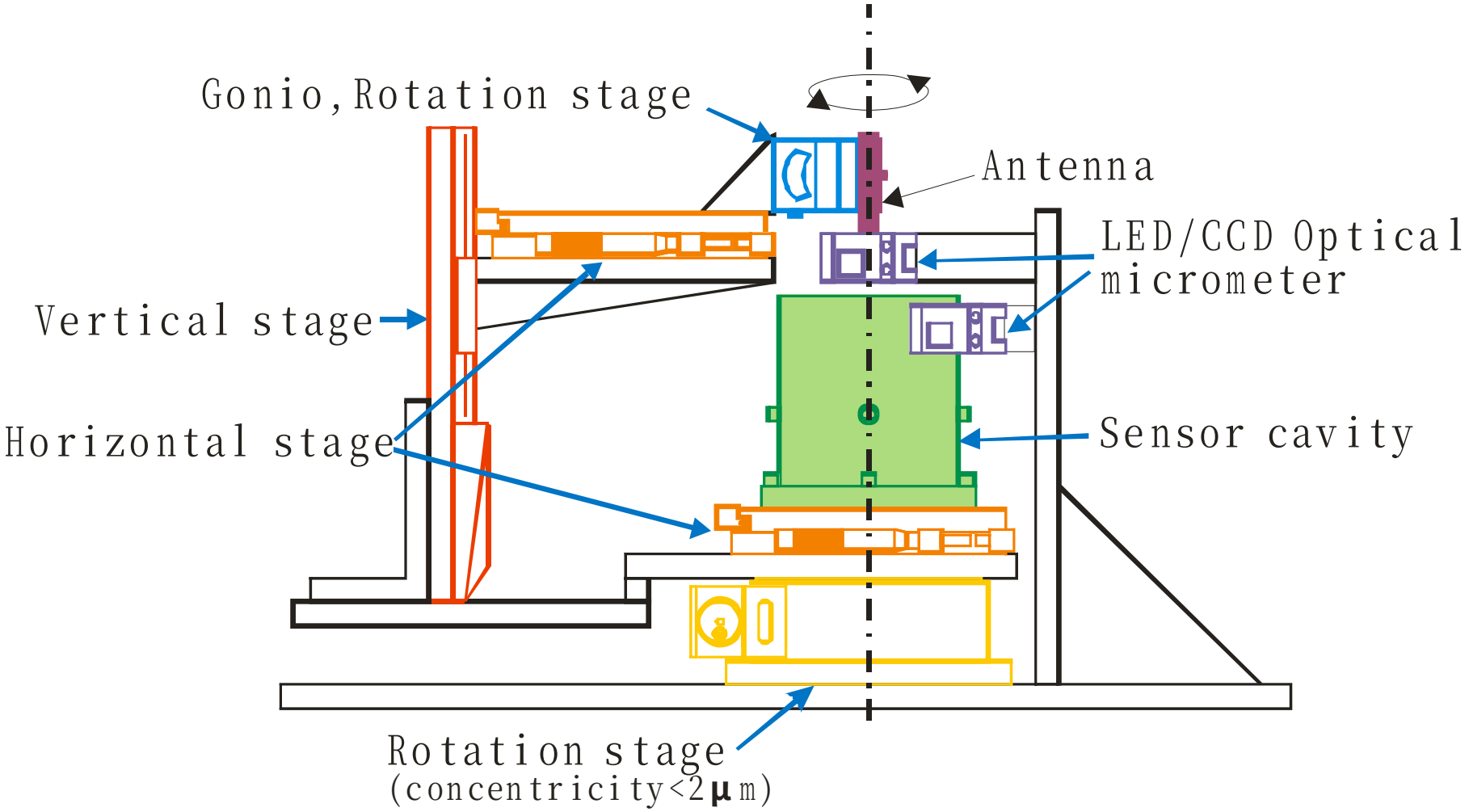




| | |
|---|---|
| A | End plate |
| B | Sensor Cavity<br>Coupling slot |
| C | Coupling Wave guide<br>Feed through |
| D | Bottom block |

# Antenna with precise mechanical center

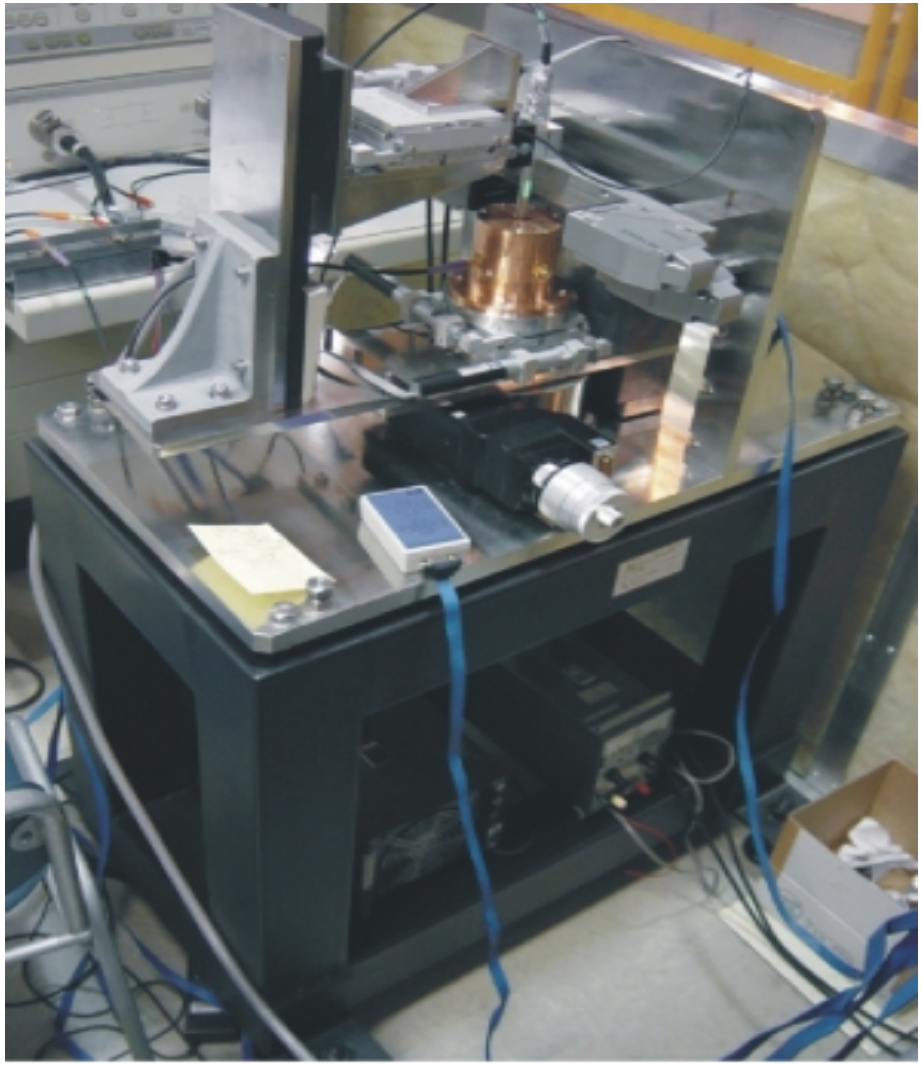


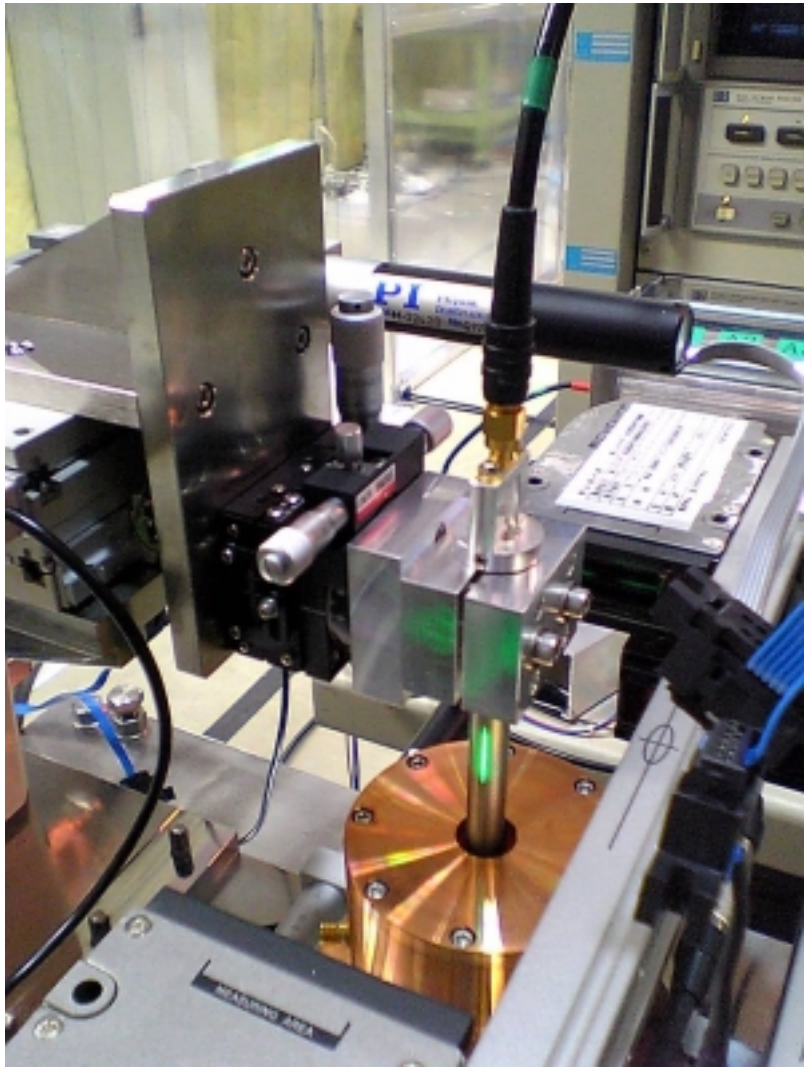

# 3.Measurement device of mechanical center



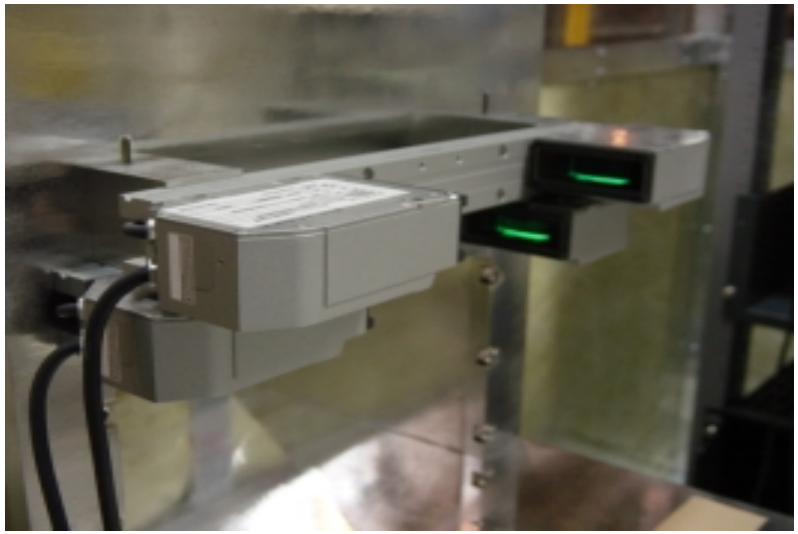

Measurement accuracy ≒2μm

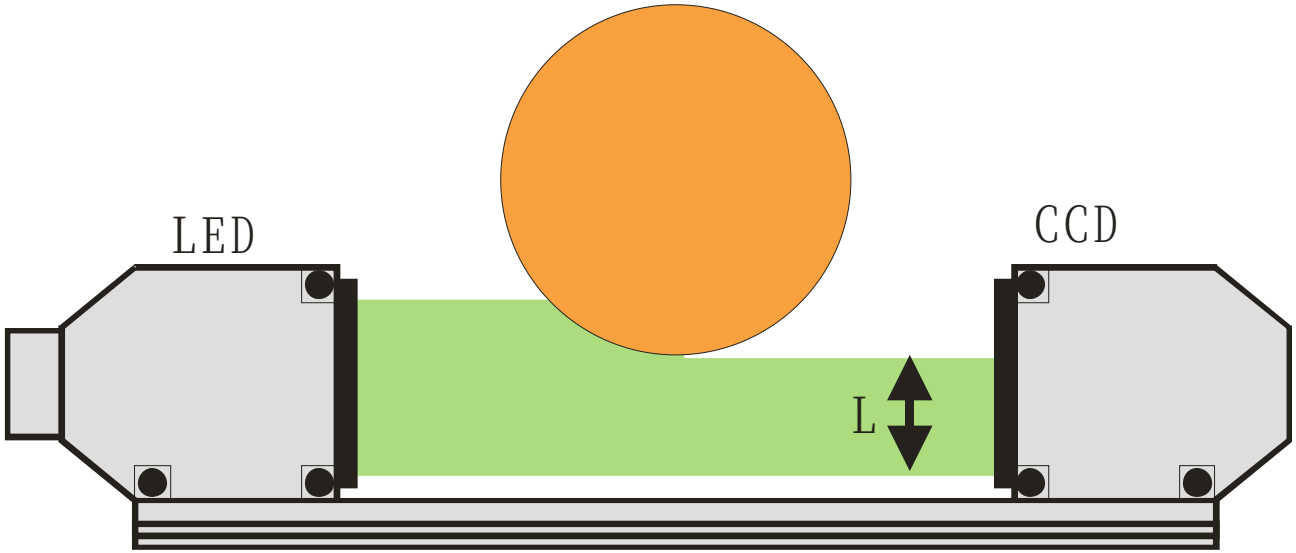
- Measurement device of  mechanical center





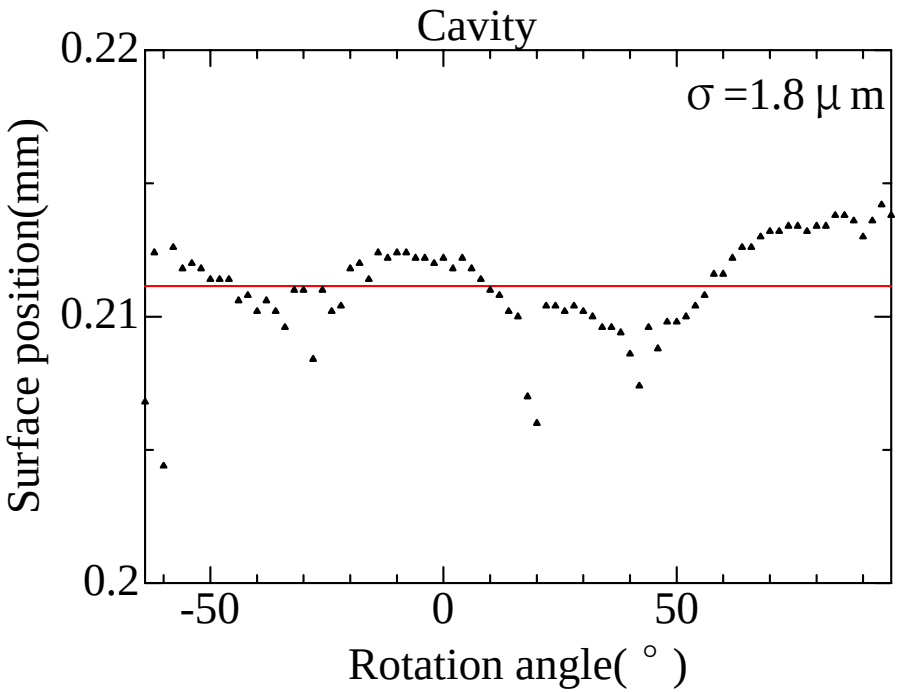
# LED/CCD Optical micrometer

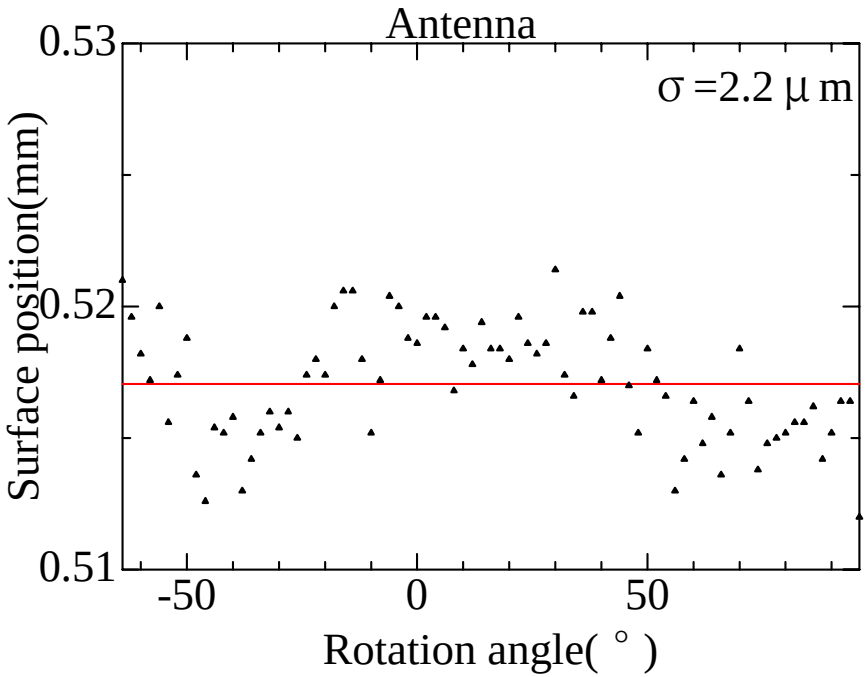


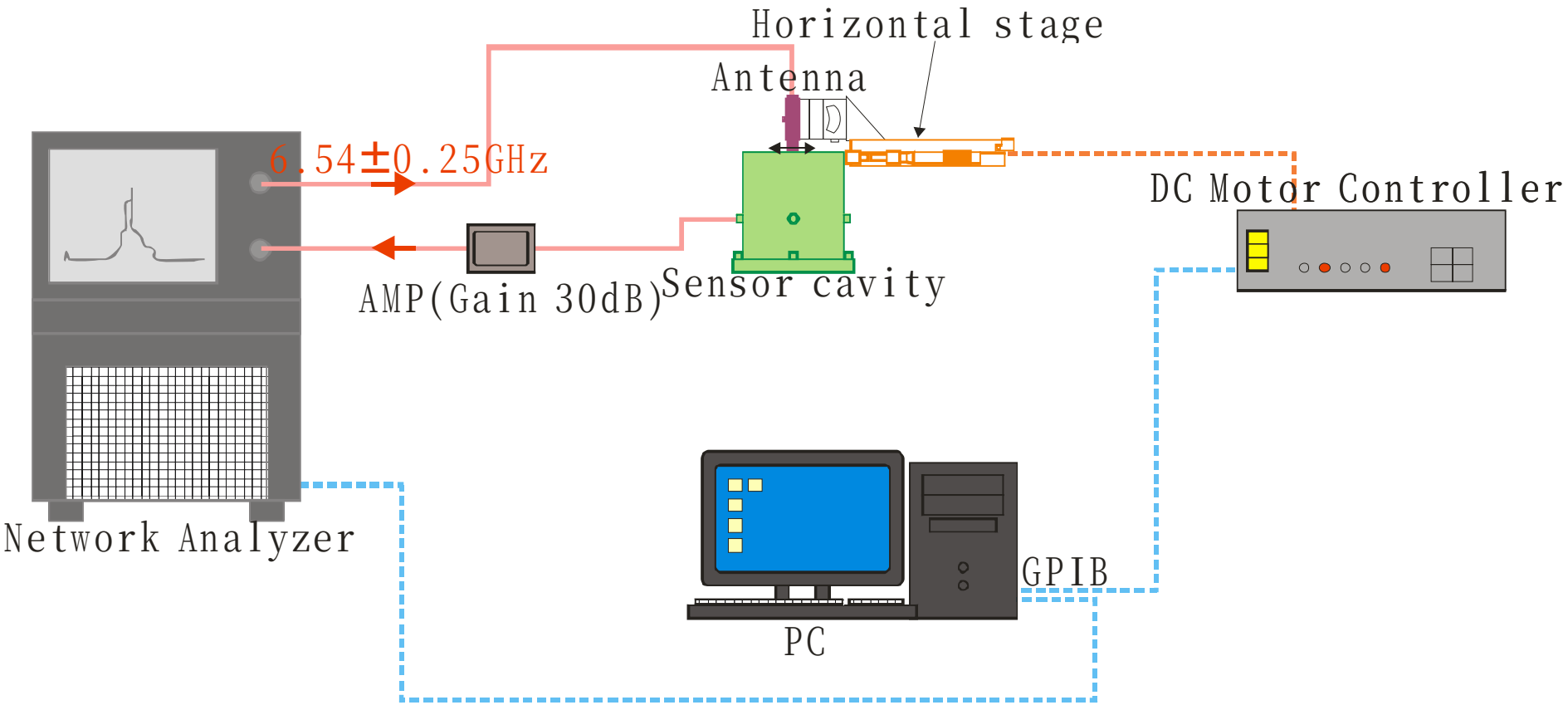

| | |
|---|---|
| Manufacture | Keyence |
| Device Name | LS-7000 |
| Accuracy | 1.5 μm |
| Repeatability | <±0.15 μm |

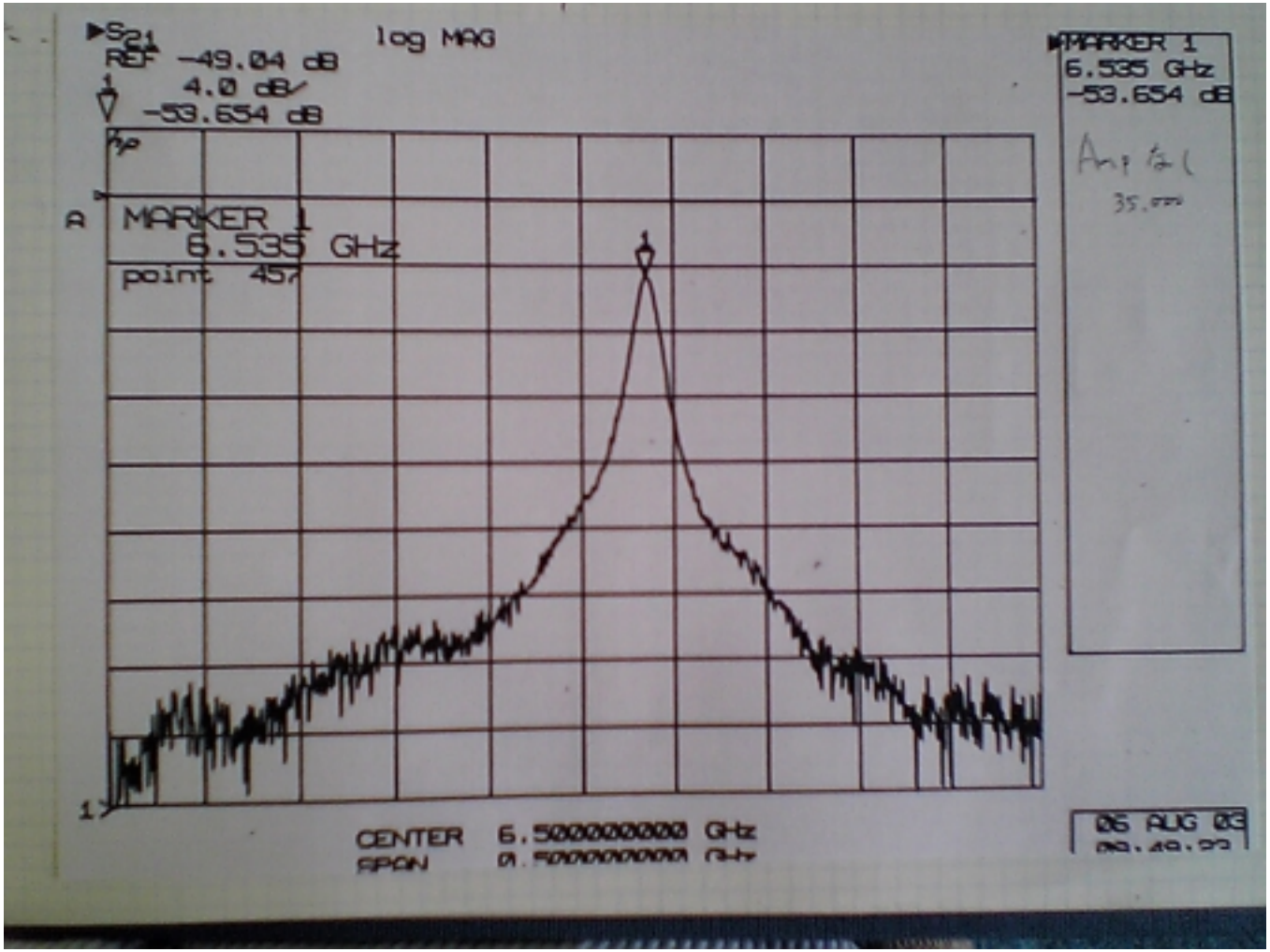
# ▪Centering of Cavity and Antenna



# ▪Measurement setup of electrical center

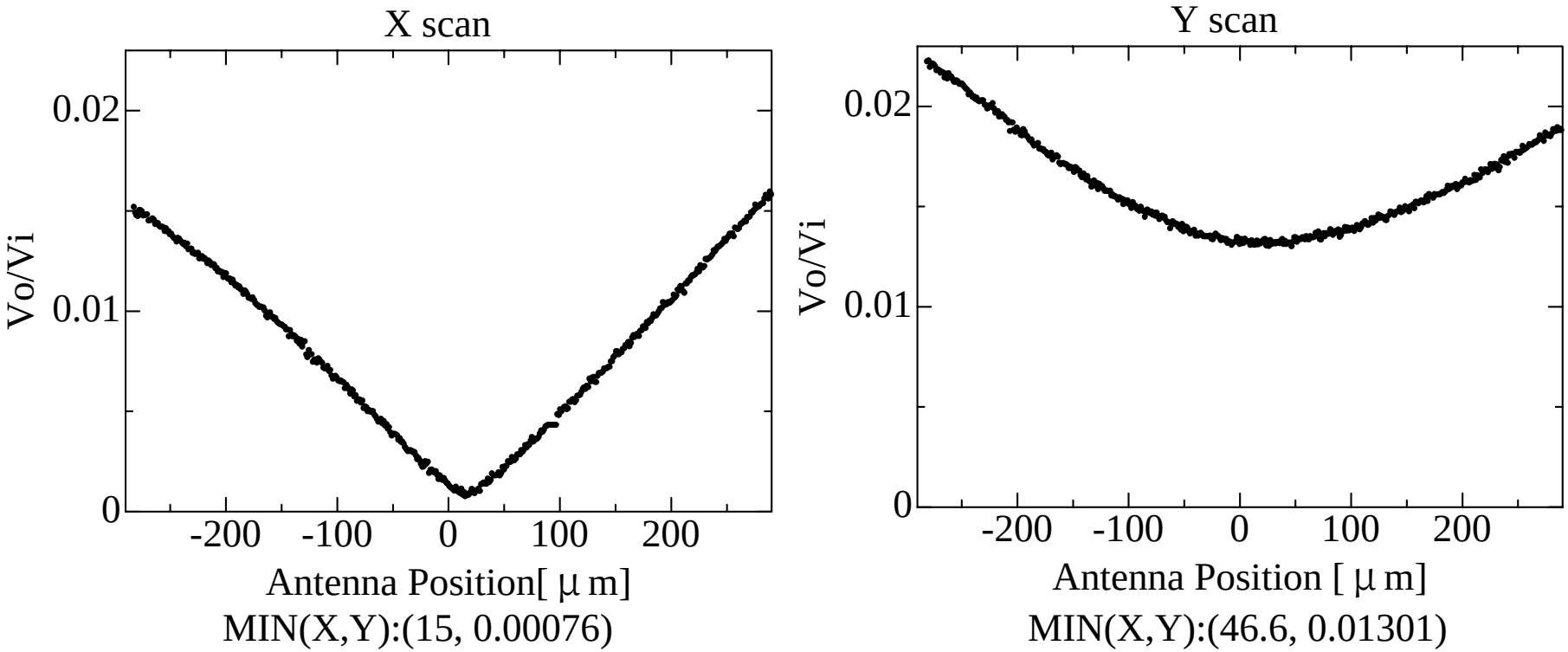





Frequency response of Sensor Cavity (No Amp)

(6.54±0.25GHz)

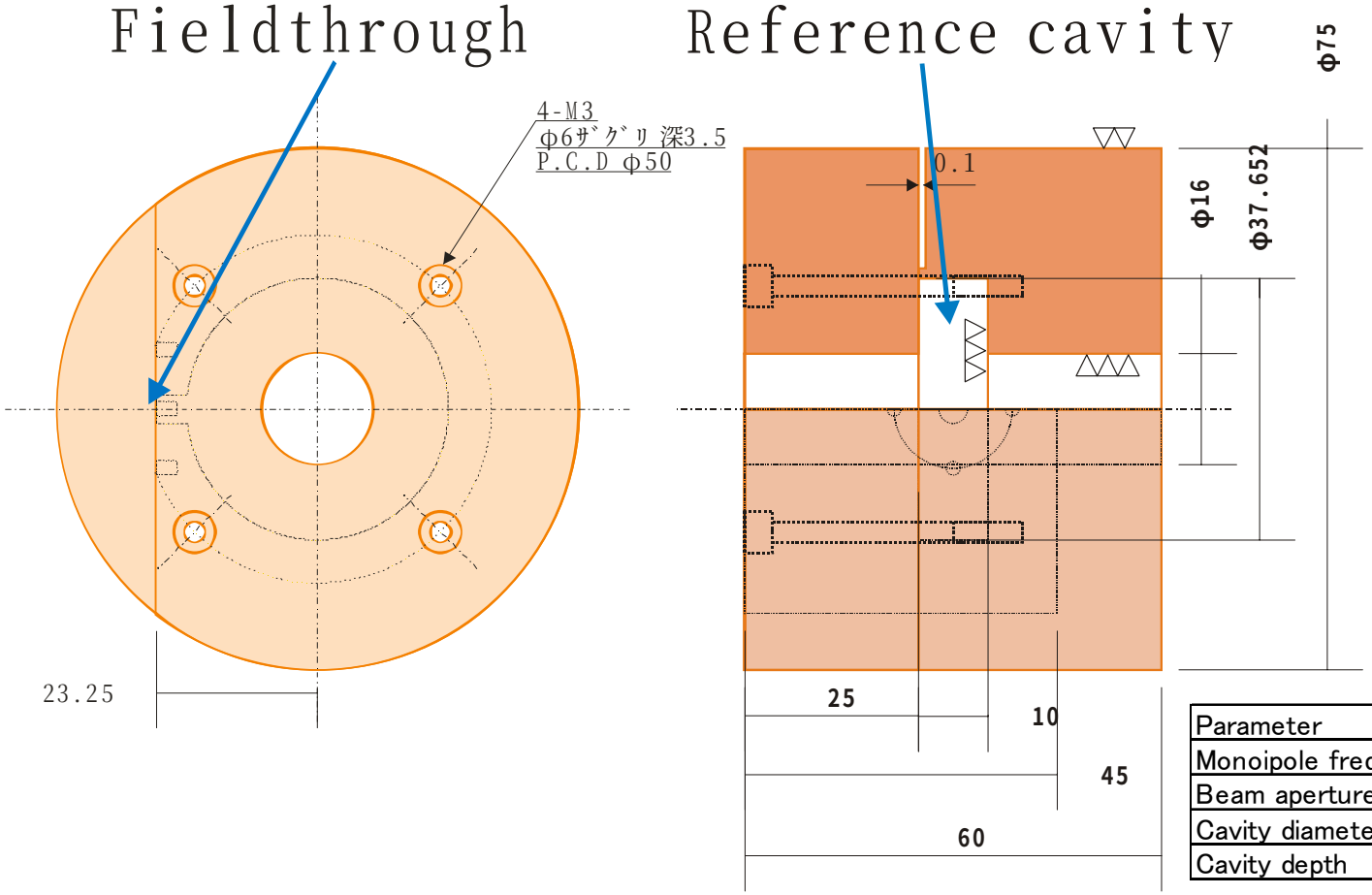
# 4.Preliminary Results of electrical center




Deviation between mechanical center and electrical center:48.9 $\mu$m

Different shape comes from Antenna mode mixing

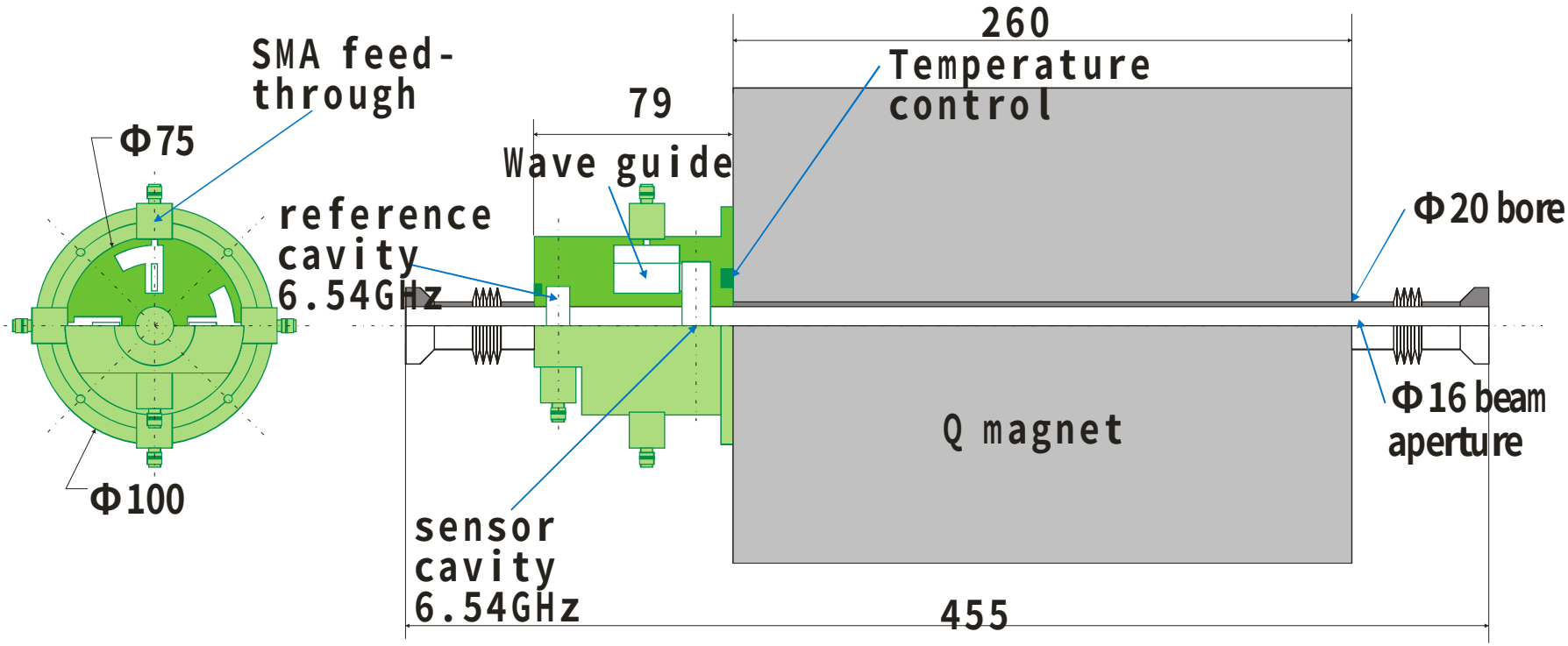
# 5.Low power model of reference cavity




| Parameter | Value |
|---|---|
| Monoipole frequency | 6.54GHz |
| Beam aperture diameter | 16mm |
| Cavity diameter | 37.653mm |
| Cavity depth | 10mm |

TM010 Cavity for phase and intensity detection

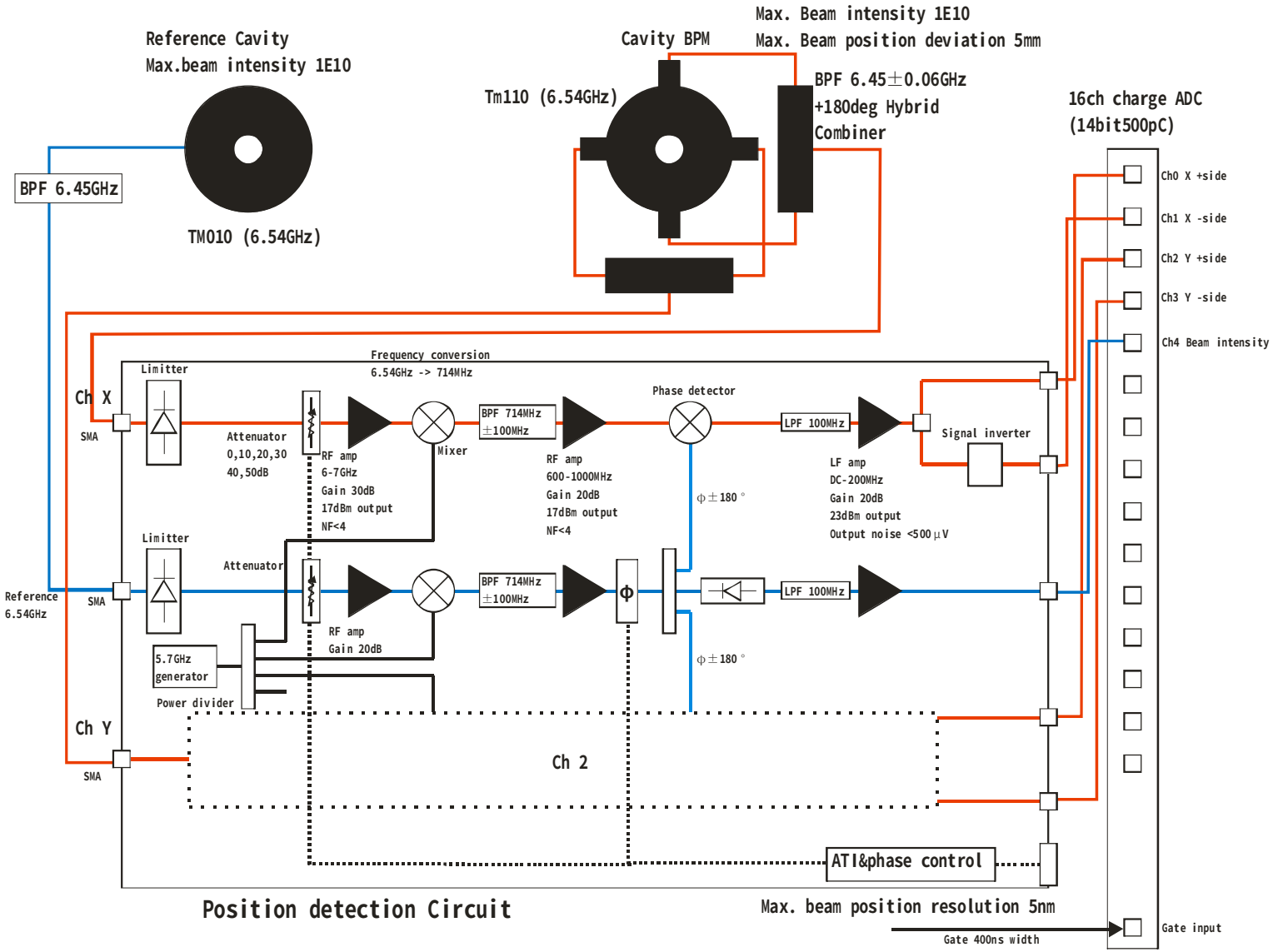
# 6.Plan of beam experiment model




Reference cavity and Sensor cavity are in one body.

BPM body is installed inside Quadrupole magnet.

# 7.Plan of detection circuits



# ・Summary

・Precision of mechanical center measurement is about 2 $\mu$ m by outer surface.

・Distance between mechanical center and electrical center was 48.9 $\mu$ m(Preliminary Results) .

But this measurement is affected by Antenna mode mixing.

・Beam experiment model will be fabricated in February 2004.

・Detection circuits will be coming in December 2003.