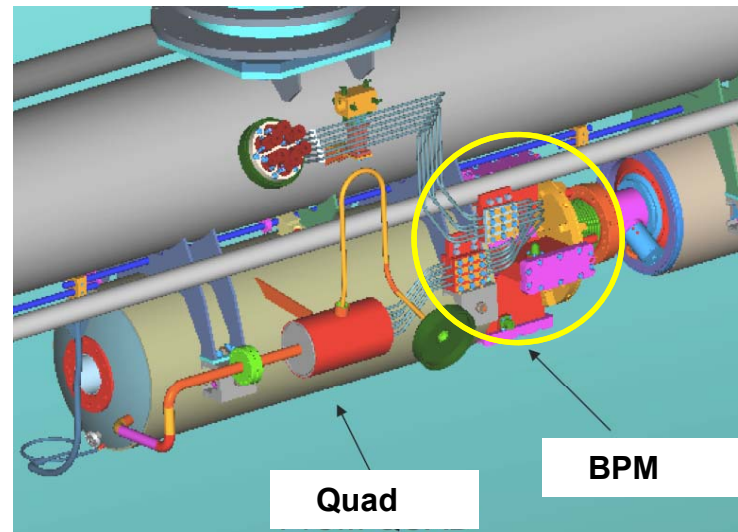


Beam Test status and Plans of the ILC Main LINAC BPM

**Hitoshi Hayano (KEK),
Sun Young Ryu, Jung Keun Ahn (Pusan National University)**

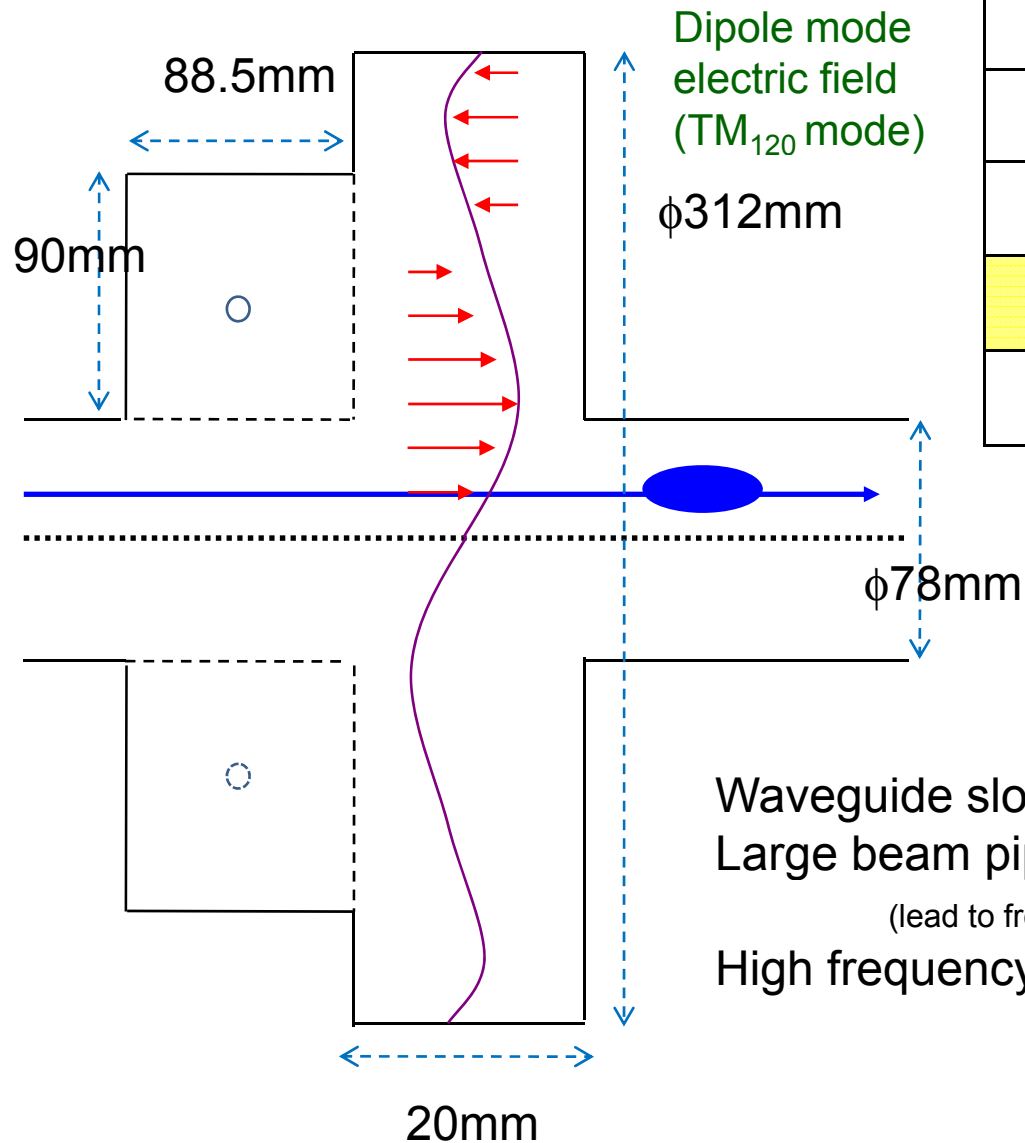
Quad-BPM package in ILC Cryomodule



Requirement of the Main LINAC BPM for ILC

- High resolution **< 1 μ m** for single pass
: Good fiducialization capability with respect to magnetic center, good common-mode rejection required.
- Big beam-pipe aperture (78mm diameter)
- HPR washable and cleanness required
- Need to withstand wide thermal excursion without vacuum leak
- Bunch-to-bunch signal acquisition required(low QL) **Bunch spacing : 369ns**
- No interference with cavity HOM and accelerating frequency.

TM120 mode BPM



resonance freq. [GHz]	Q ₀
0.77275 (TM ₀₁₀)	1039
1.0407 (TM ₁₁₀)	1009.4
1.8278 (TM ₀₂₀)	1623.4
2.043 (TM ₁₂₀)	1328.1
2.1756	1638.5

Waveguide slot coupling : for CM rejection

Large beam pipe : large diameter cavity

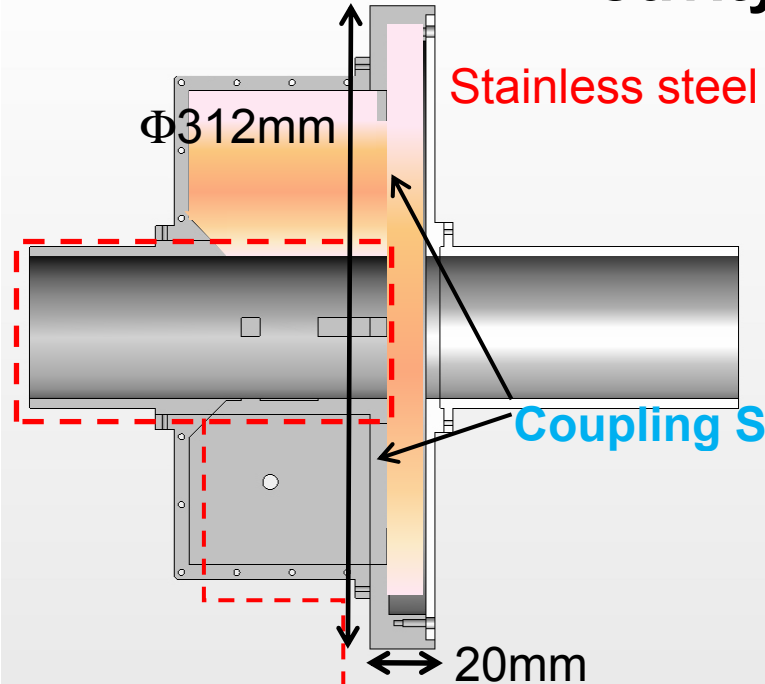
(lead to freq. lower, become lower than WG cutoff)

High frequency mode : for better coupling to WG,

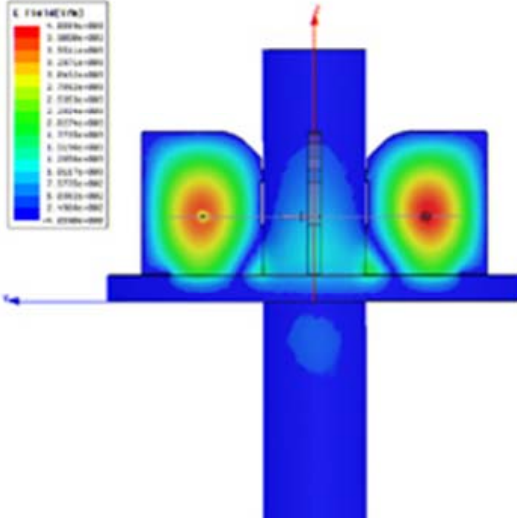
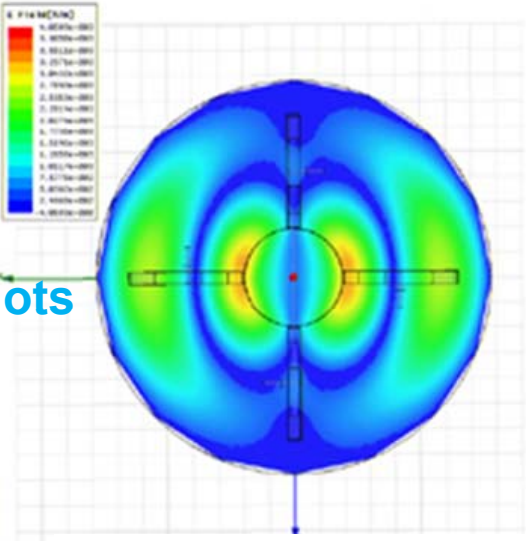
for less coupling to low freq. CM.

(because of WG cut-off)

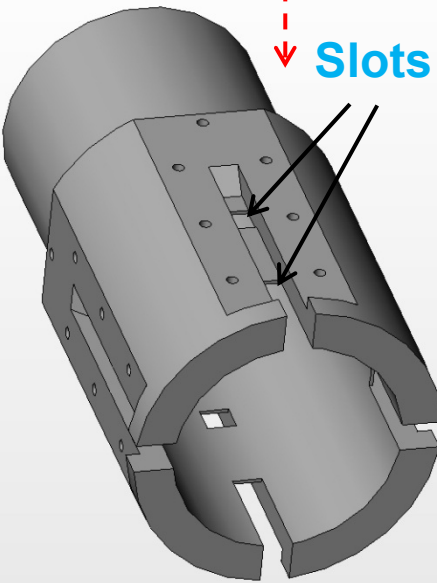
Cavity-BPM RF design (use of TM120)



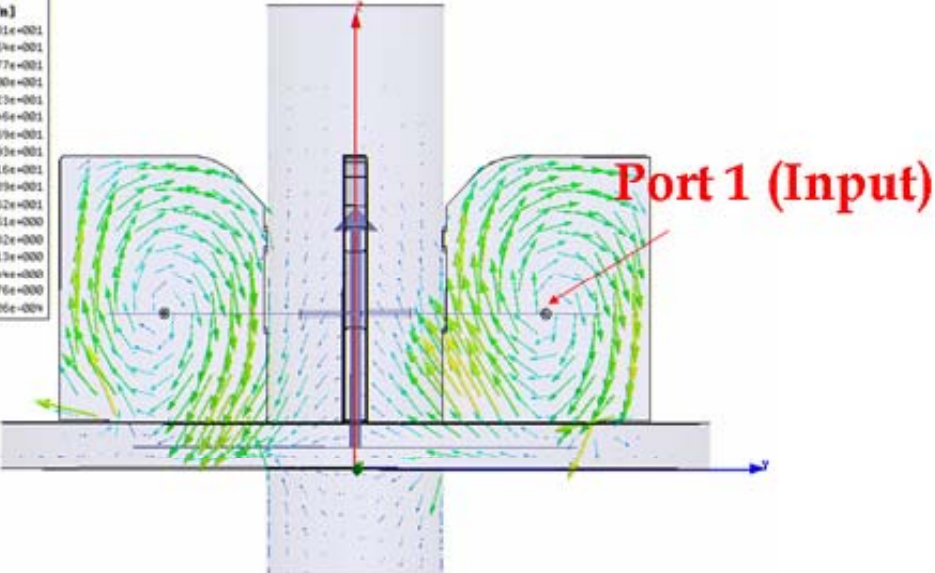
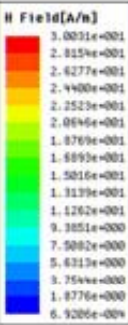
Calculation by HFSS



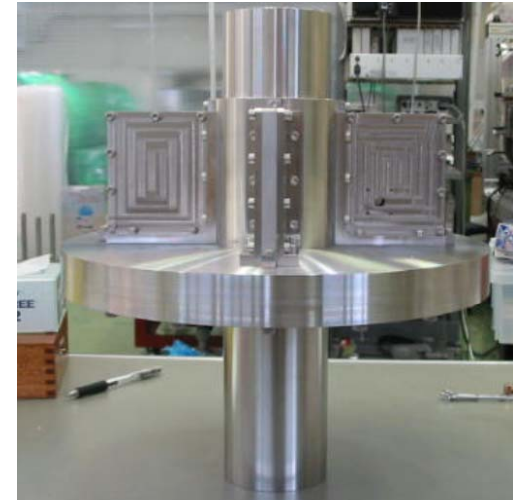
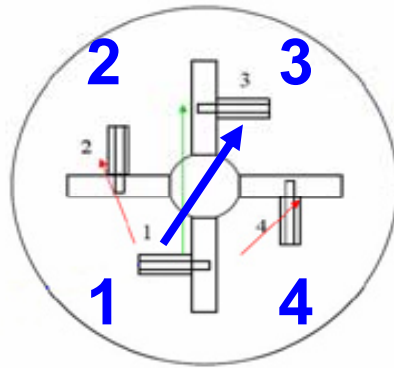
Slots for HPR wash



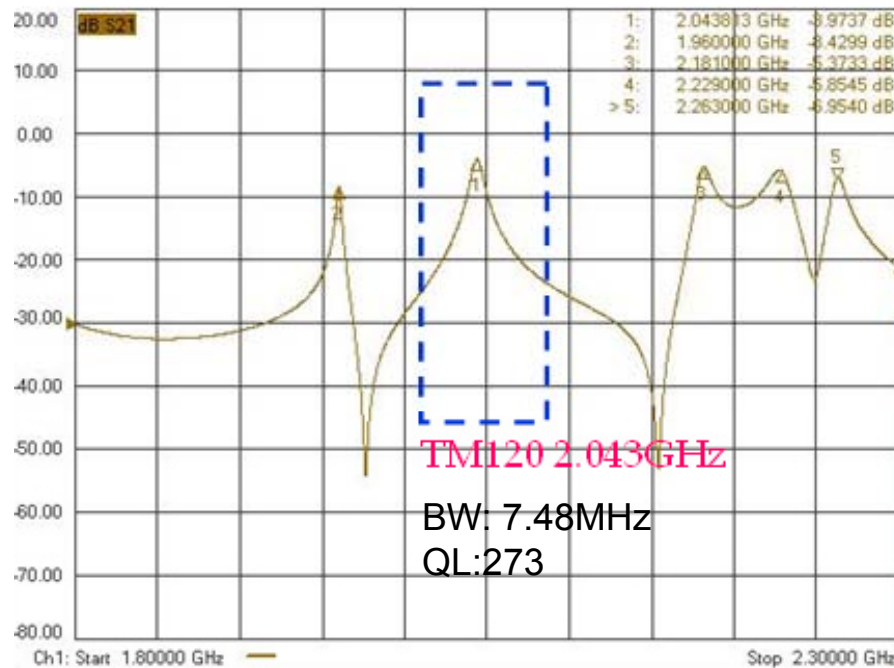
f_0	2.03GHz
BW	8MHz
Q_L	254.5
β	4.2
Q_0	1323.4



RF Measurement



Transmission from 1 to 3

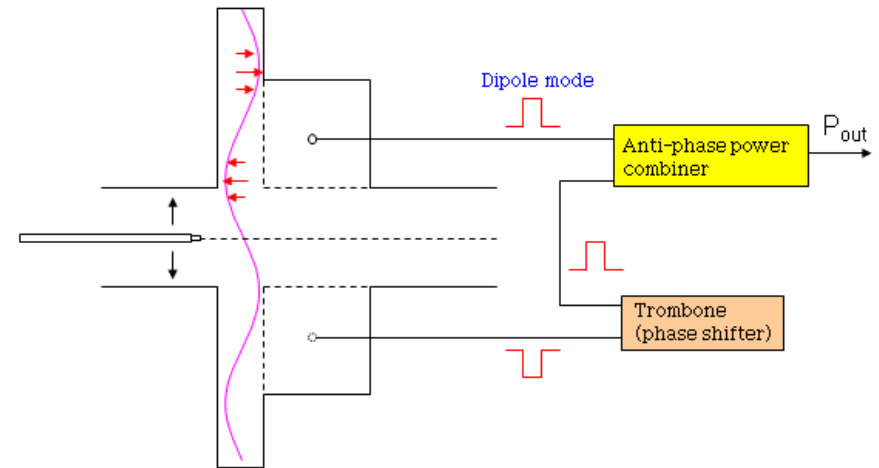
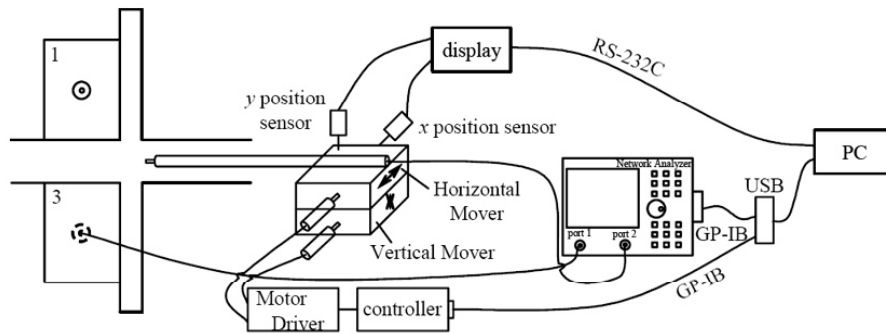


Frequency 1.8GHz~2.3GHz

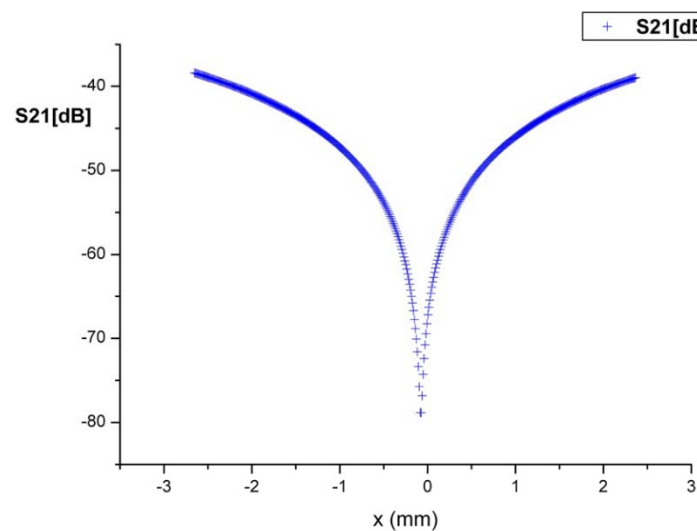
Isolation and transmission

Port 1	No	Isolation (dB)	Transmission (dB)
1	2	-41.849	、
	3	、	-3.978
	4	-39.71	、
2	1	-41.846	、
	3	-37.304	、
	4	、	-5.11

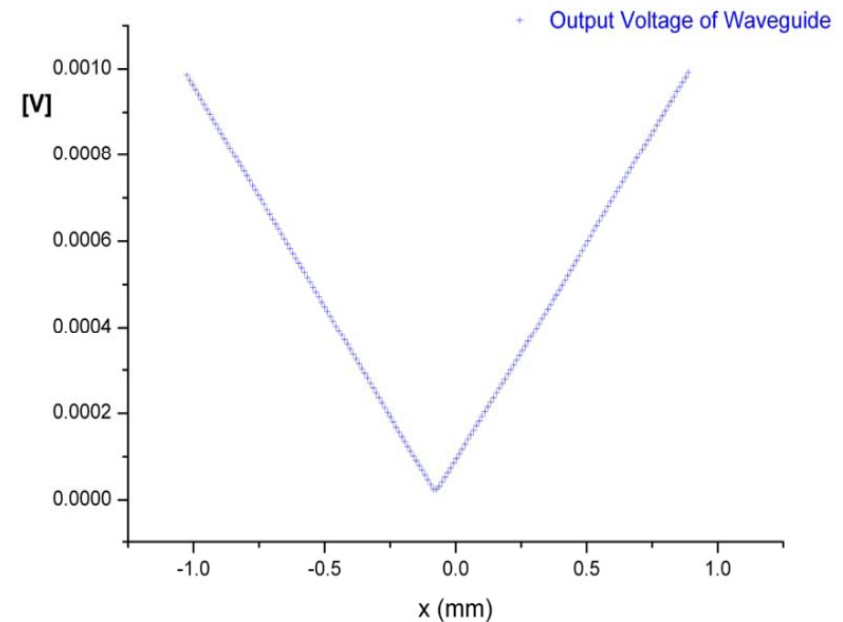
Antenna scan with common mode rejection



	position[mm]	S21[dB]	voltage[mV]
x	-0.084	-78.819dB	0.0252



Output Voltage

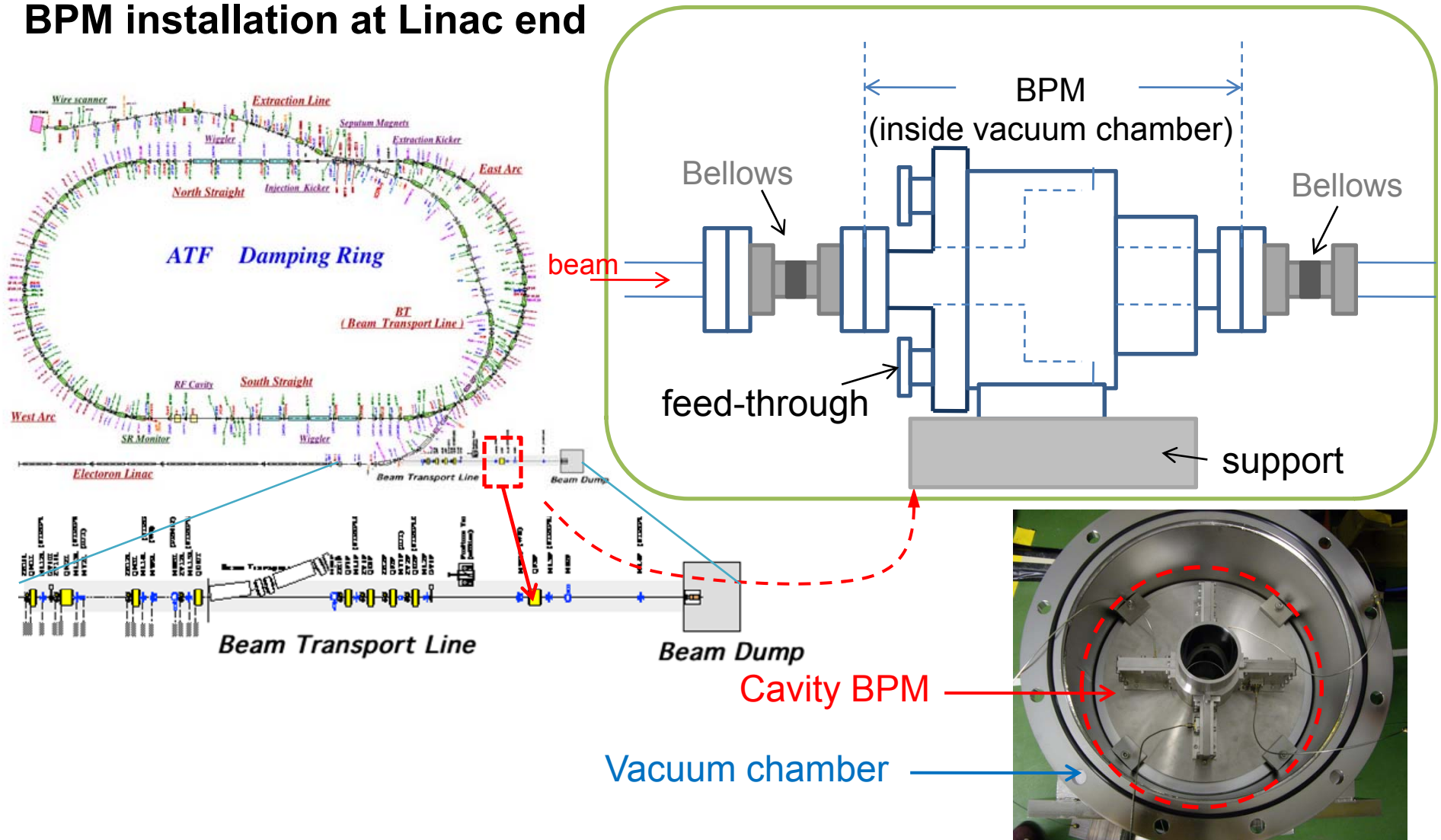


very clear V-shape response

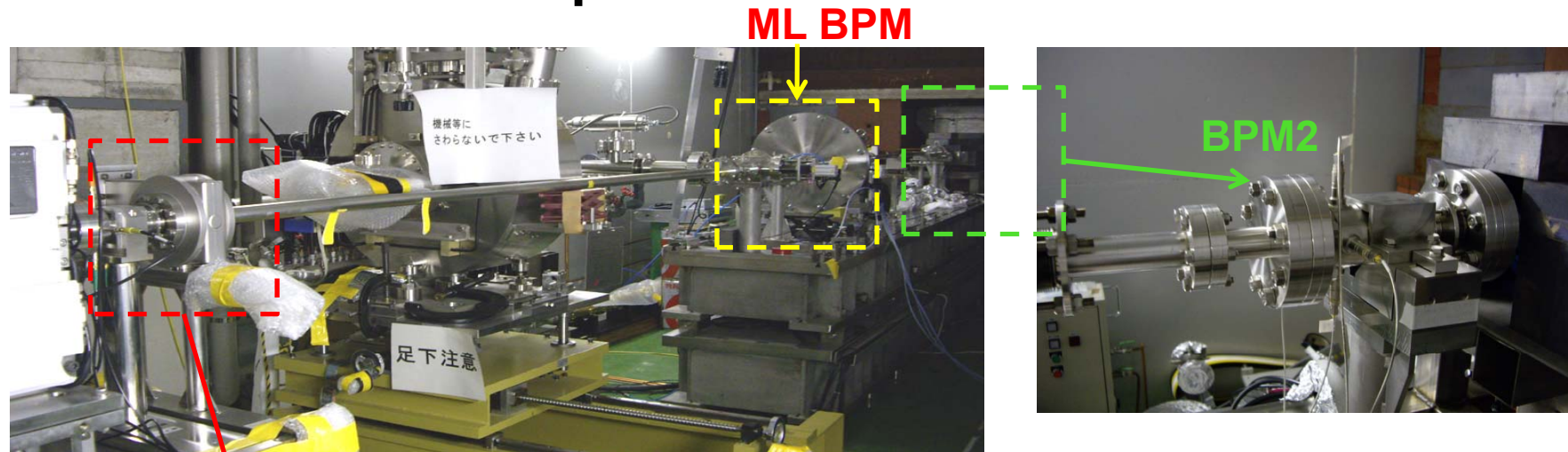
Beam Test at ATF LINAC (May 2008)

Beam Energy : 1.28GeV Beam Intensity : 1.0×10^{10} electrons/bunch

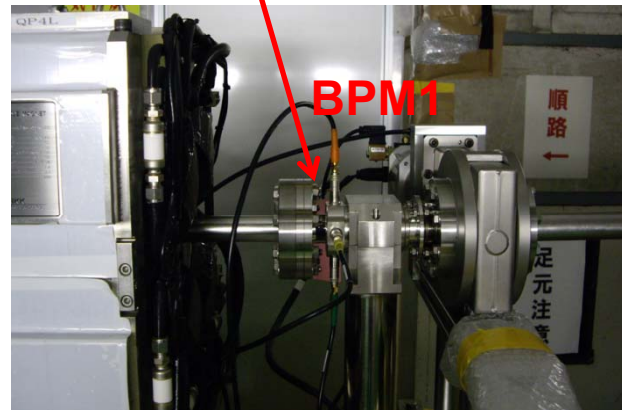
BPM installation at Linac end



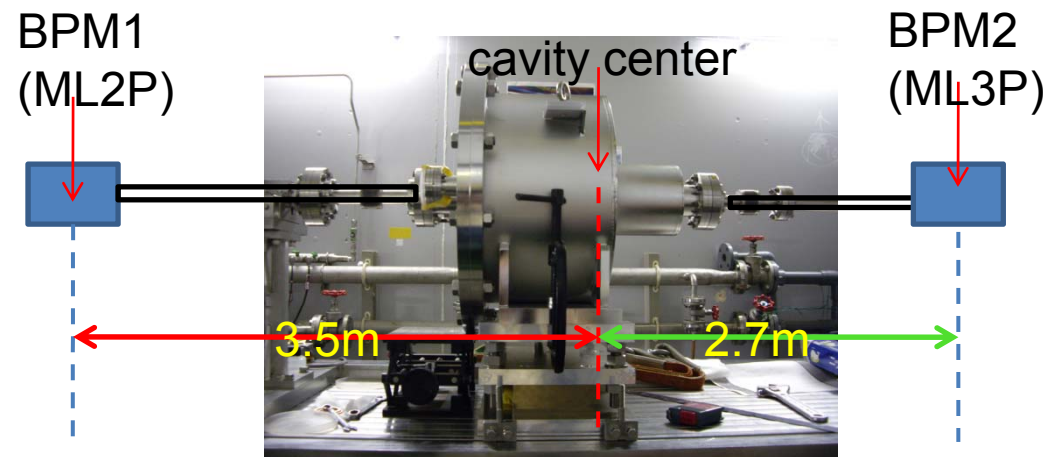
Beam Test Set up



Strip line BPM (ML3P)

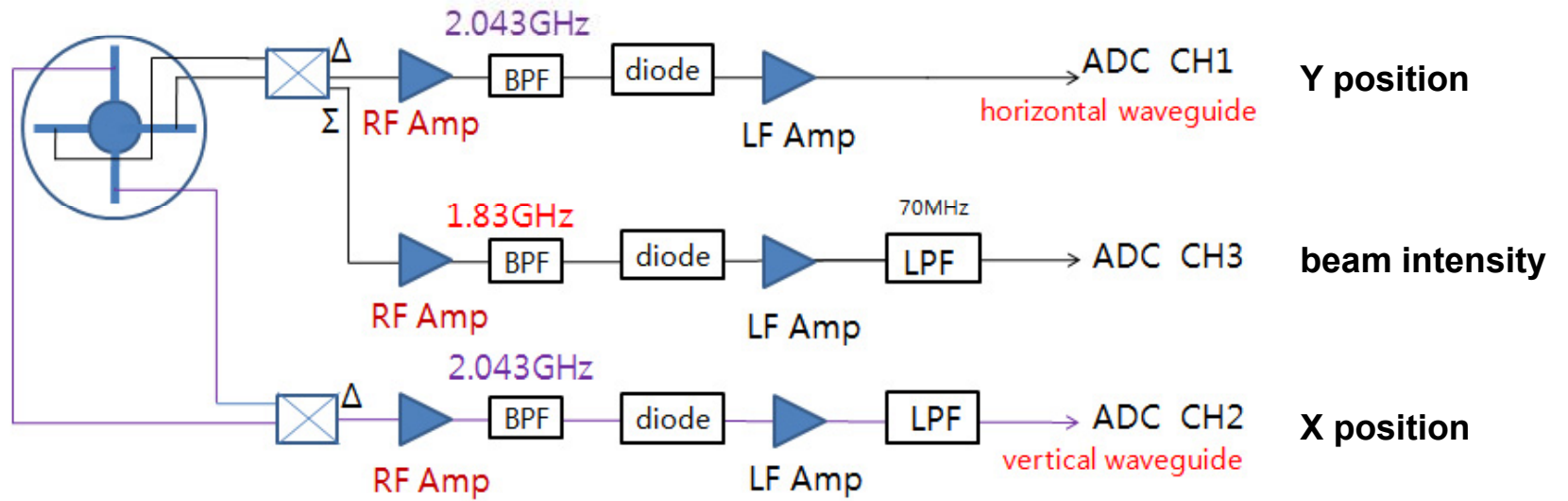


Strip line BPM (ML2P)

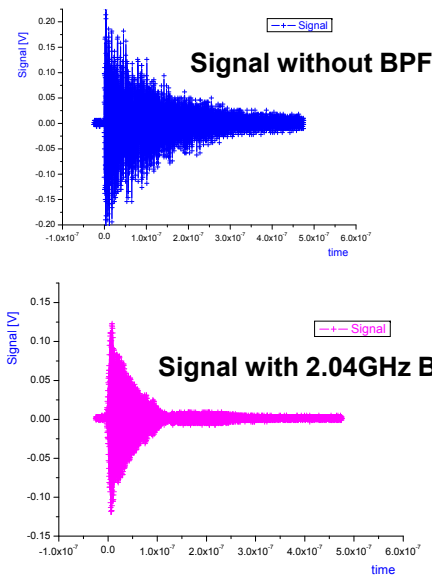
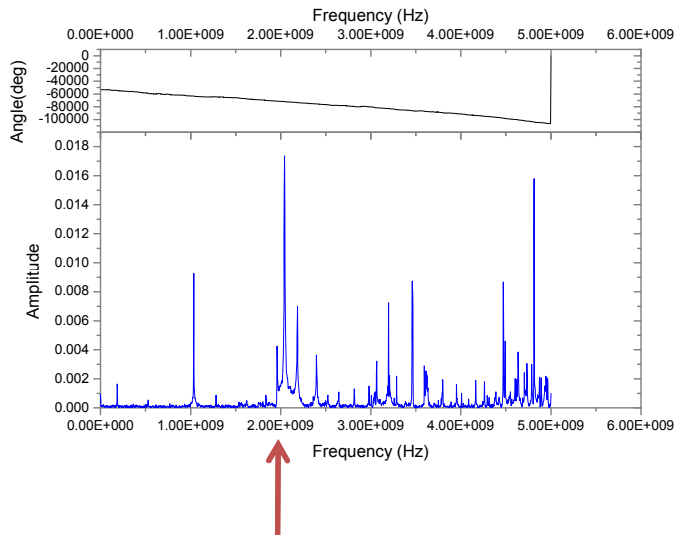


Two strip line BPMs are the reference.
(determine the orbit and beam displacement at ML BPM)

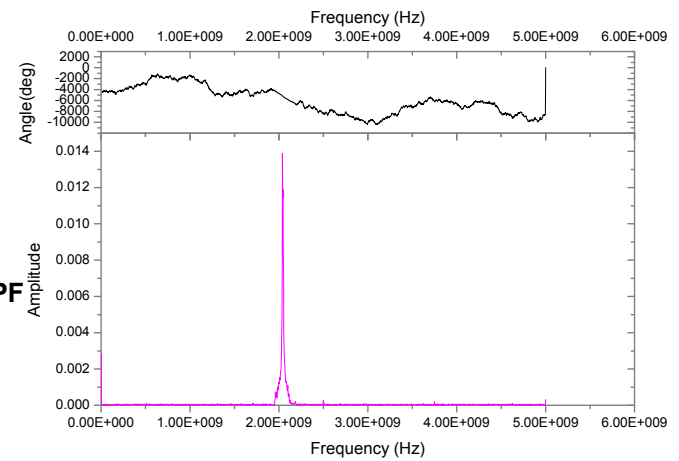
Detection Electronics



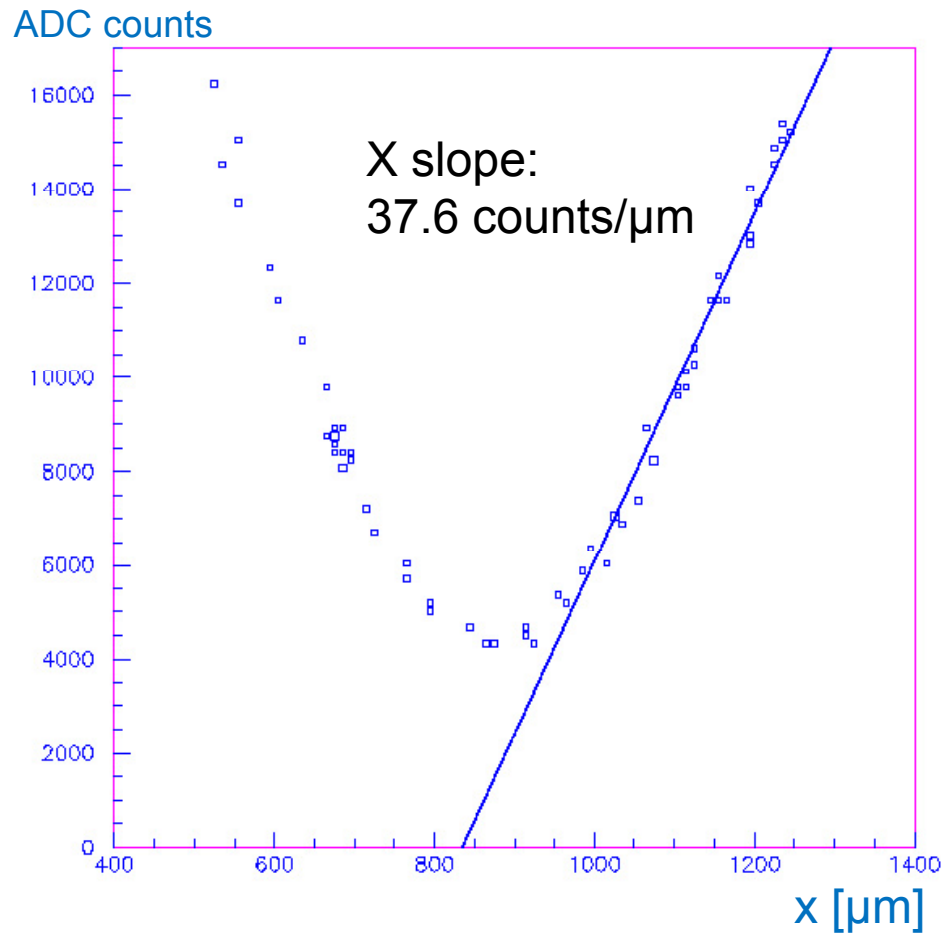
FFT spectrum without BPF



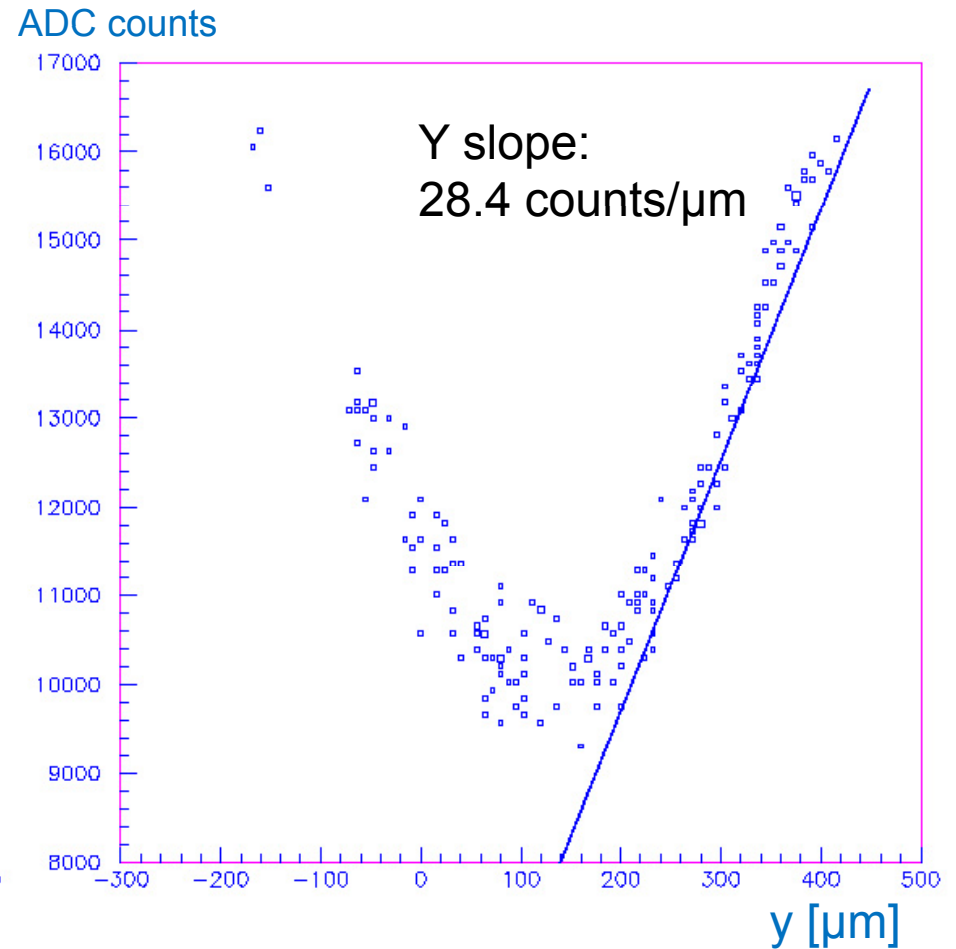
FFT spectrum with BPF 2.04GHz



Beam position measurement results



Estimated Resolution : 0.5 μm



Estimated Resolution : 0.7 μm

Resolution is OK, but
round V-shape : CM mixing? or BPM tilting?

Beam time request in January '09 [*]

BPM upgrade:

1. re-installation into tilt-adjustable mount.
alignment by Taylor-Hobson telescope.
2. Electronics upgrade
use of CM rejecter with precise adjustment of phase and amplitude.
use of down-converter and synchronous phase detector.
use of low-noise LF amplifier.
use of the same signal cables with same length for 4-port.

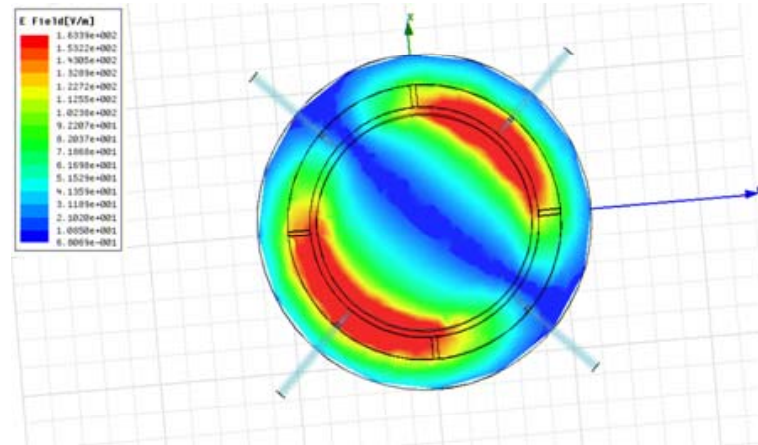
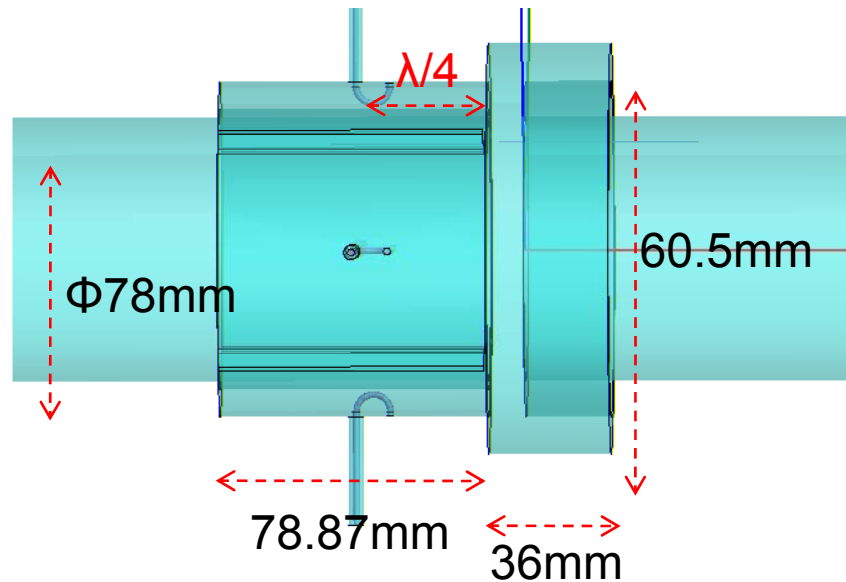
Beam time request:

- for electronics adjustment: **2 shifts** in the first week.
- for response and resolution measurement: **2 shift** in the second.

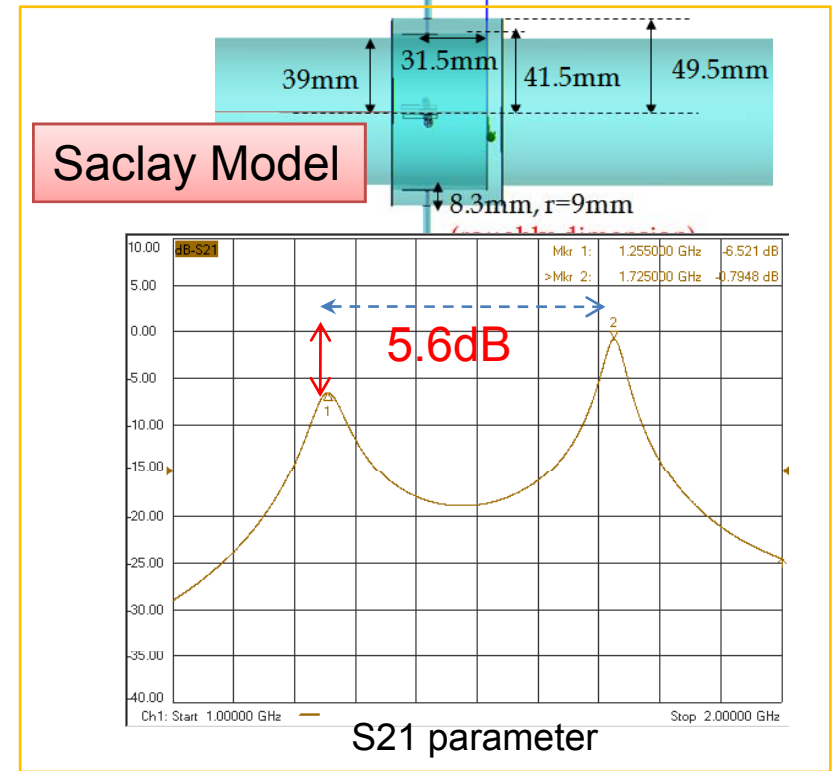
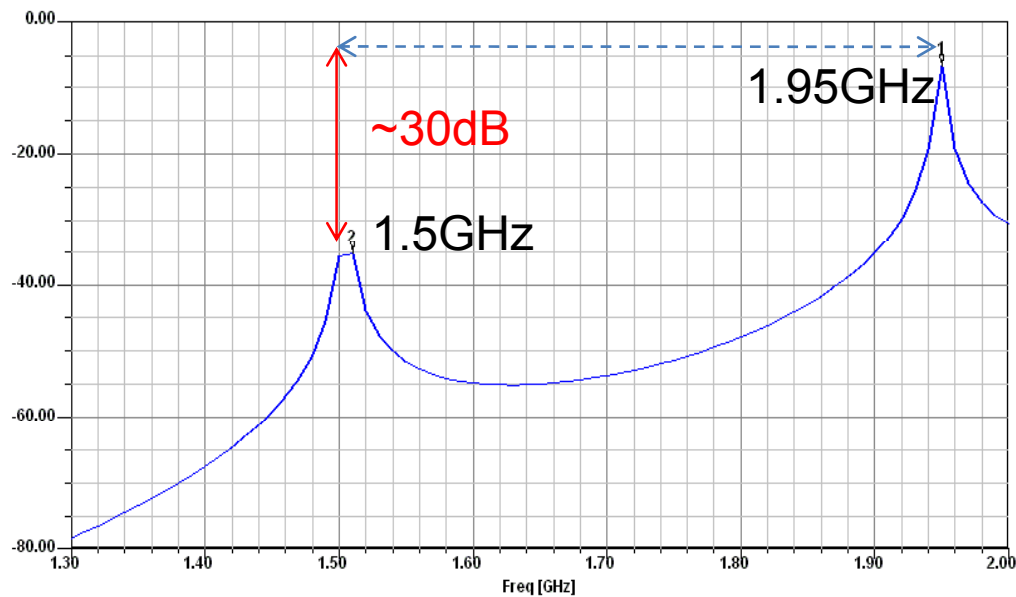
*This research will be published when we get good V-shape response (CM rejection, tilt removal, etc).

Re-entrant BPM: new design

For more compact, light weight, simple structure BPM:
 Saclay re-entrant BPM is newly re-designed by Sun Young Ryu.



S21 parameter **TM110 mode : 1.95GHz**



Another Beam time request in 2009

For more compact, light weight, simple structure BPM:
Saclay re-entrant BPM is newly re-designed by Sun Young Ryu,

The new design[*] : "Cavity Coupled Re-entrant BPM"

*This research will be done as Doctor thesis of Sun Young Ryu.

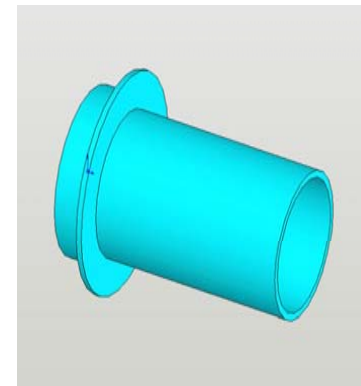
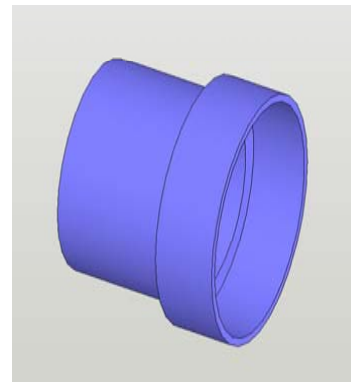
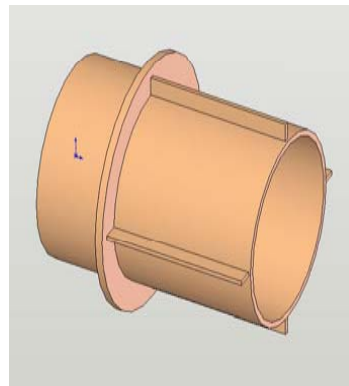
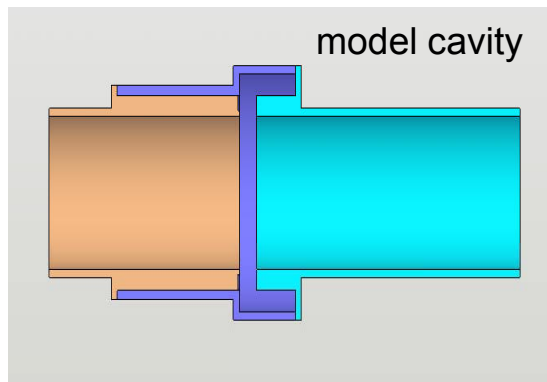
We will make **model cavity** at first,

RF measurement, antenna scan, **beam test in May 2009 (4 shifts)**.

Then, **production model** will be fabricated,

HPR wash test, cool-down test,

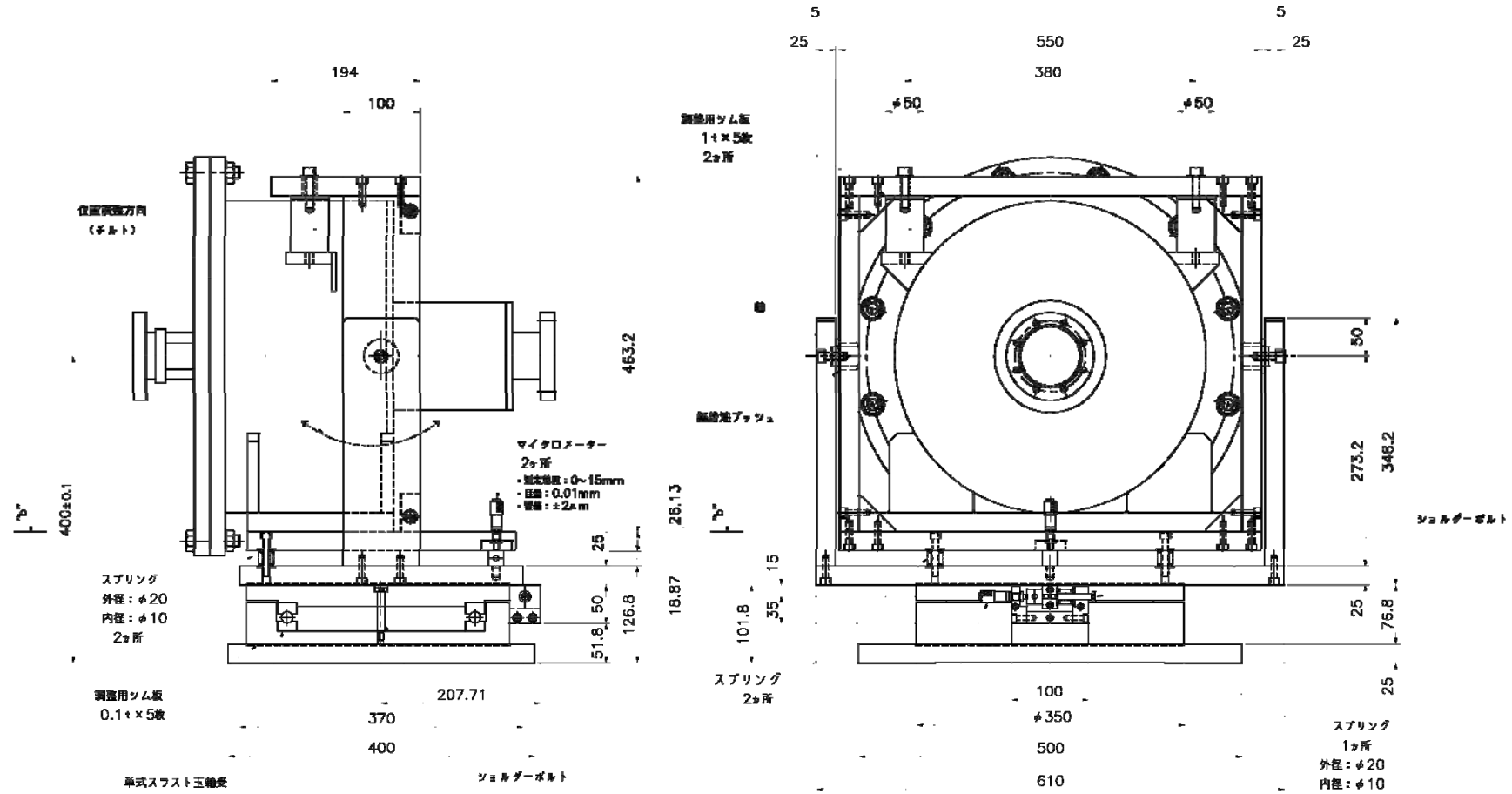
and **beam test in October 2009 (4 shifts)**.



end

Backup Slides

BPM chamber Tilt adjustment



マイクロナーター

表面処理: 11. L 仕上

三角法	尺	1/5	承認	客先	電子エネルギー加速器研究機構 殿
			承認	機種	空間型ビーム位置モニター内蔵真空管装置位置調整台
			製作	製造	正味工業 株式会社
			小形機	得意	KE 5114
材質: SUS304			製造	電話	3-05504A
製作数: 1台					株式会社 ケーバック

Main Linac BPM beam test circuit

2008.10.16 H. Hayano

