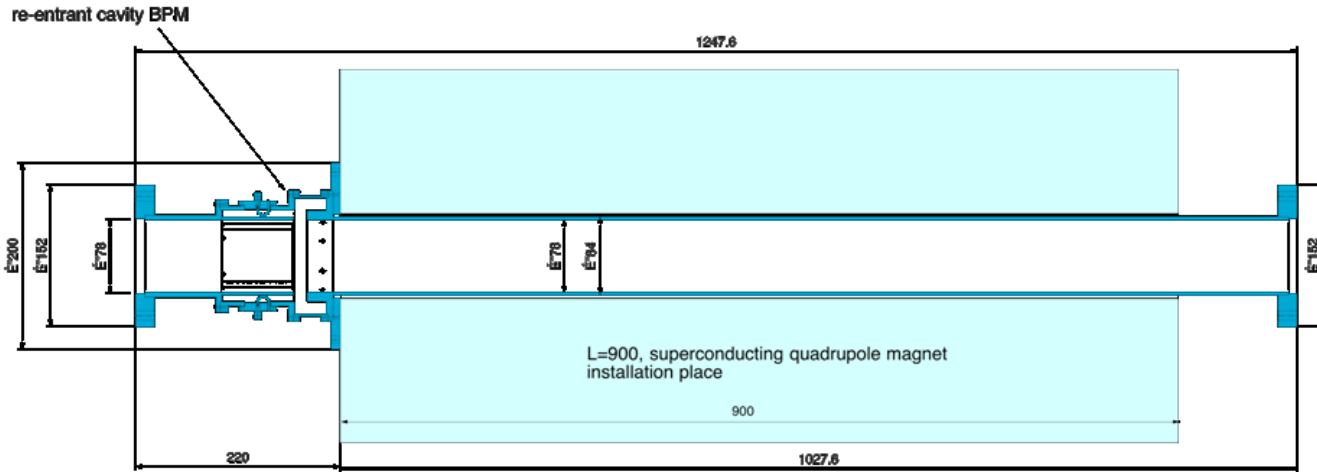


# Cold BPM development in KEK

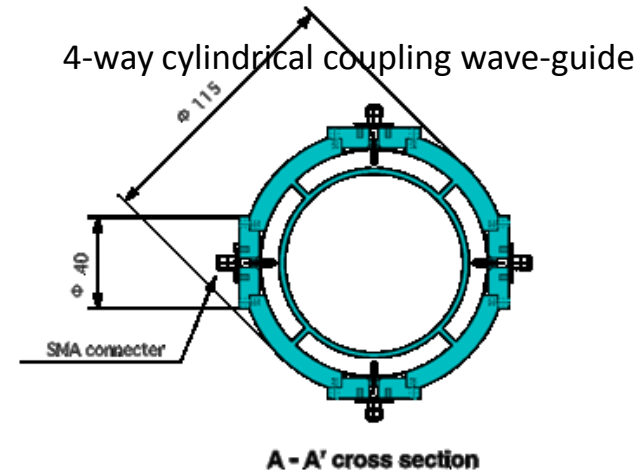
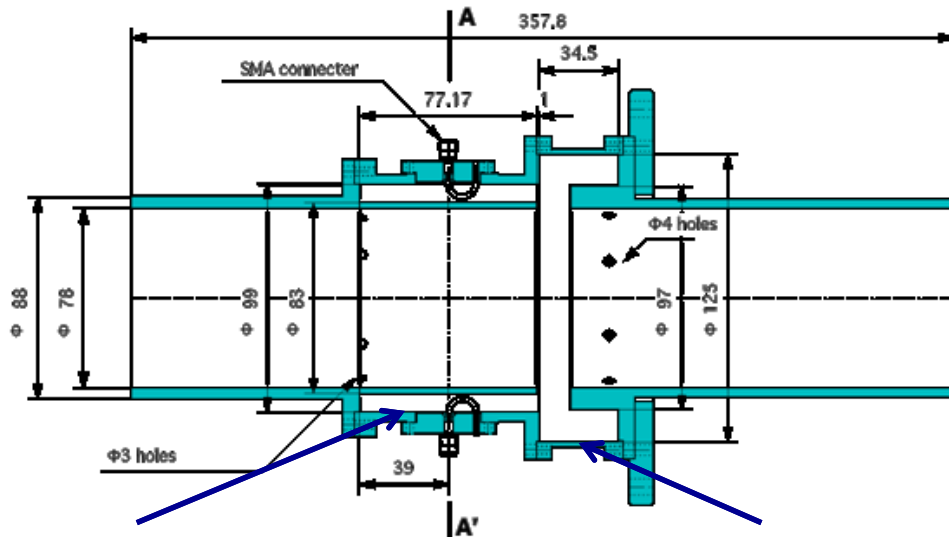
H. Hayano, March 2011

Jung Keun Ahn (PNU), Sun young Ryu (PNU),  
Eun San Kim (KNU), Young Im Kim (KNU), Jin yeong Ryu (KNU),  
Hitoshi Hayano (KEK)

# STF cold-BPM for phase-2 cryomodule



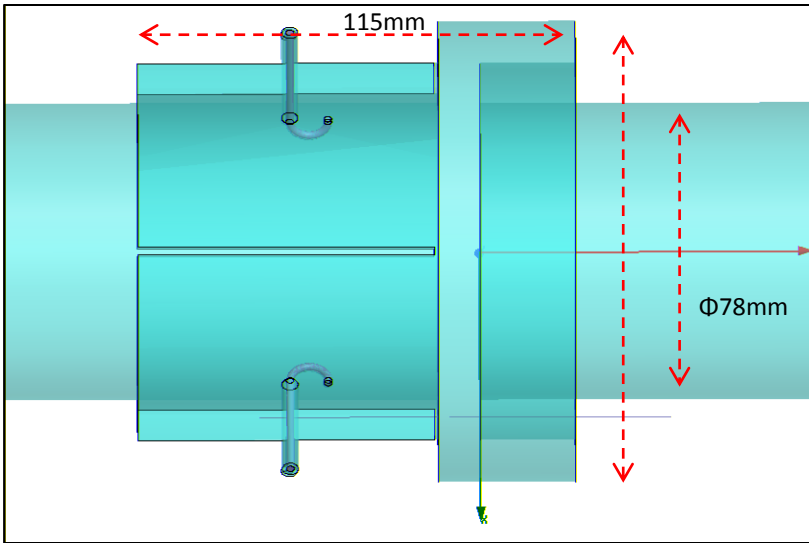
Main Linac Beam position monitor  
Prototype  
conceptual drawing



4-way cylindrical coupling wave-guide

Re-entrant type cavity BPM

# re-entrant cavity + coupling waveguide structure



- (1) Modification from Saclay re-entrant BPM
- (2) common-mode rejection by coupling WG
- (3) More compact than cylindrical cavity BPM
- (4) HPR washable simple structure
- (5)  $\varnothing 78\text{mm}$  big beam pipe
- (6)  $< 1\mu\text{m}$  resolution for each bunch in the train
- (7) low-Q value for less interference between bunch

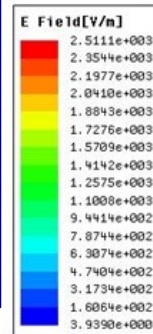
Port1 to Port3

Frequency: 2.049 GHz

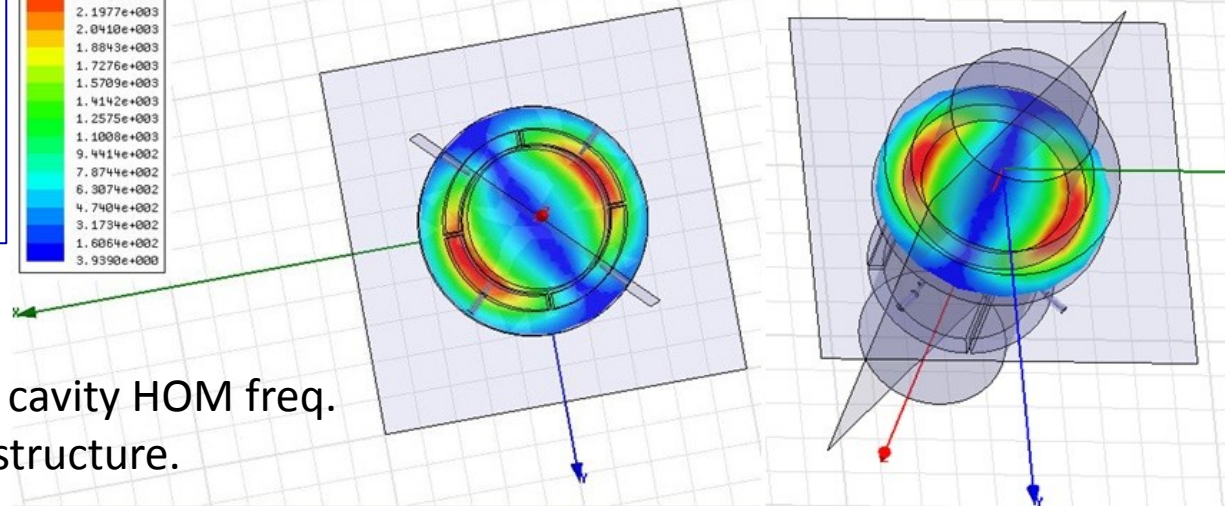
QL : 205

$\beta$  : 0.635

isolation to other port : -27dB



Eigen-mode of re-entrant cavity: dipole mode



Frequency selection :

Avoid dark current freq. , Avoid cavity HOM freq.

Appropriate freq for re-entrant structure.

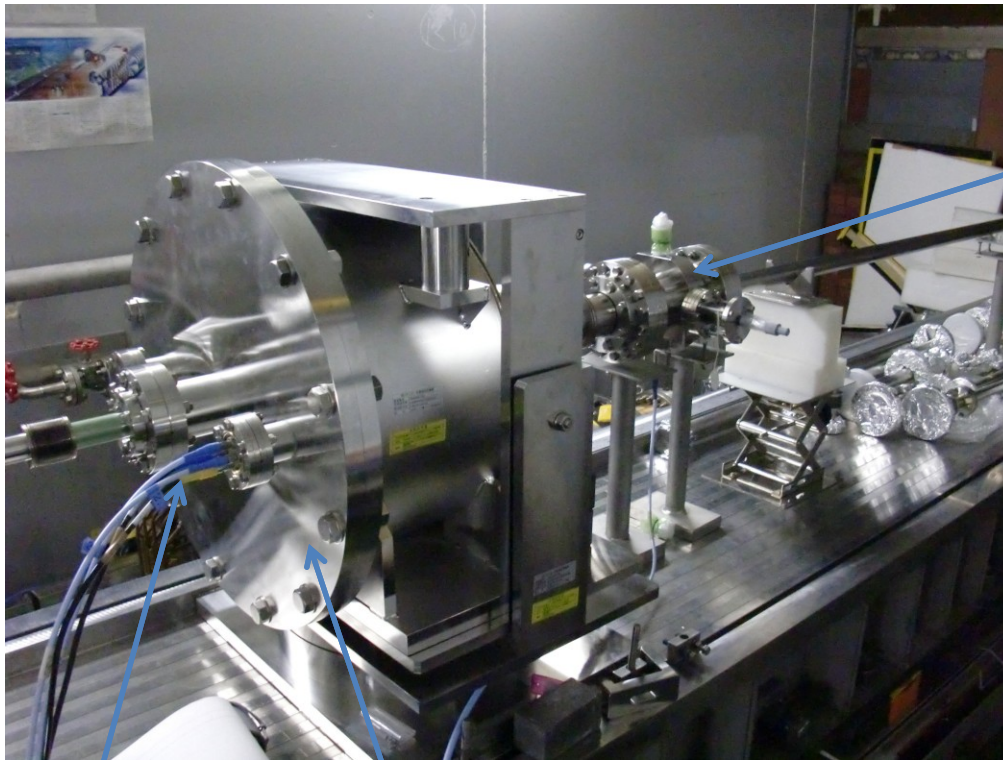
## Prototype-BPM : building block type (non-vacuum tight)



Material: SUS



# Beam test set-up in ATF Linac

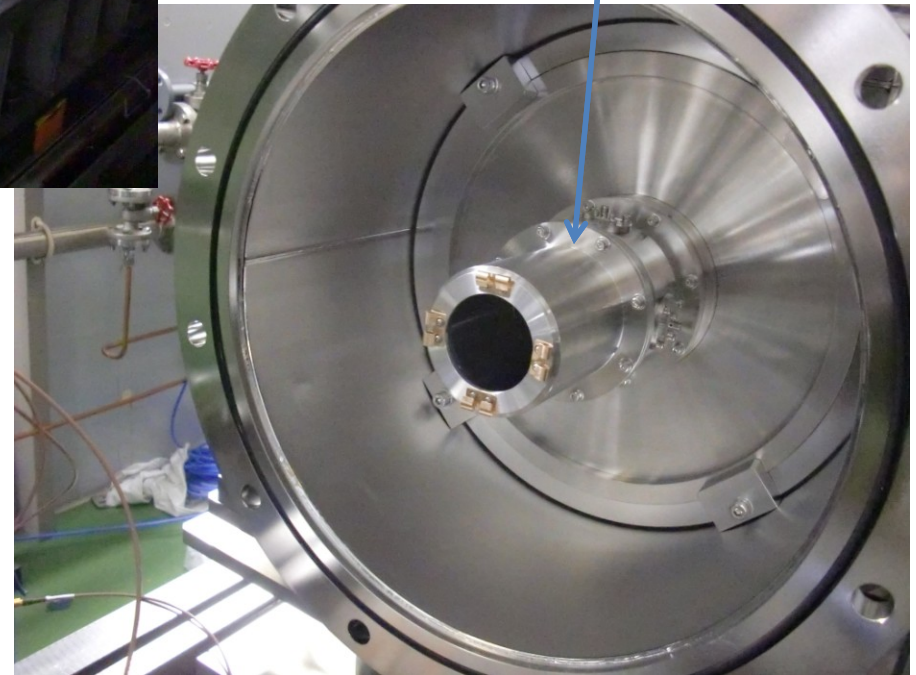


Reference cavity

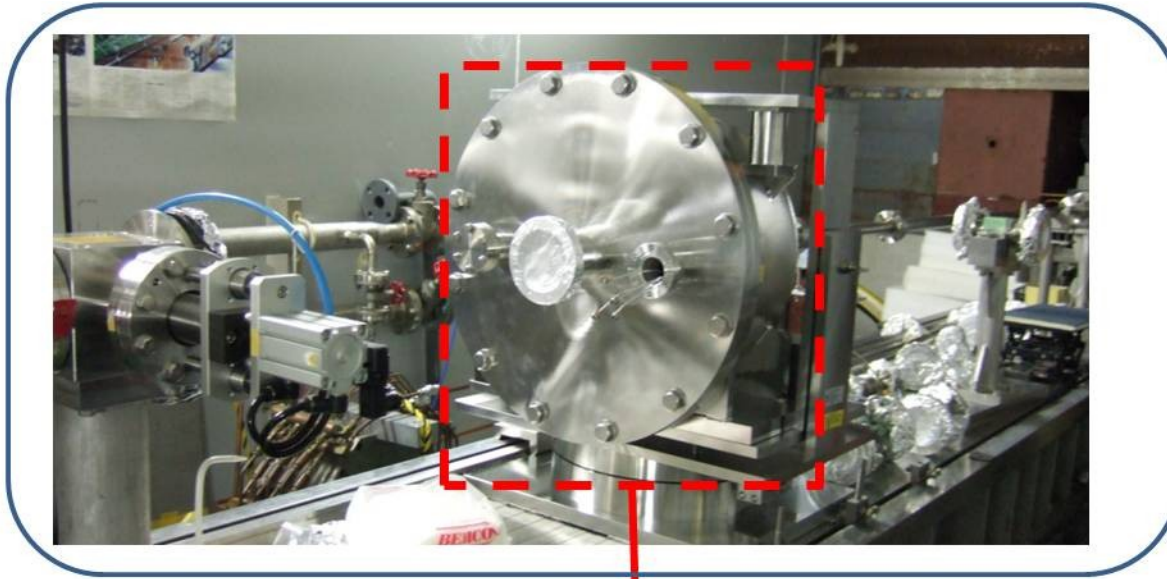
Proto-type BPM installed  
in the vacuum chamber housing

Vacuum chamber housing  
with tilt and yaw angle adjuster

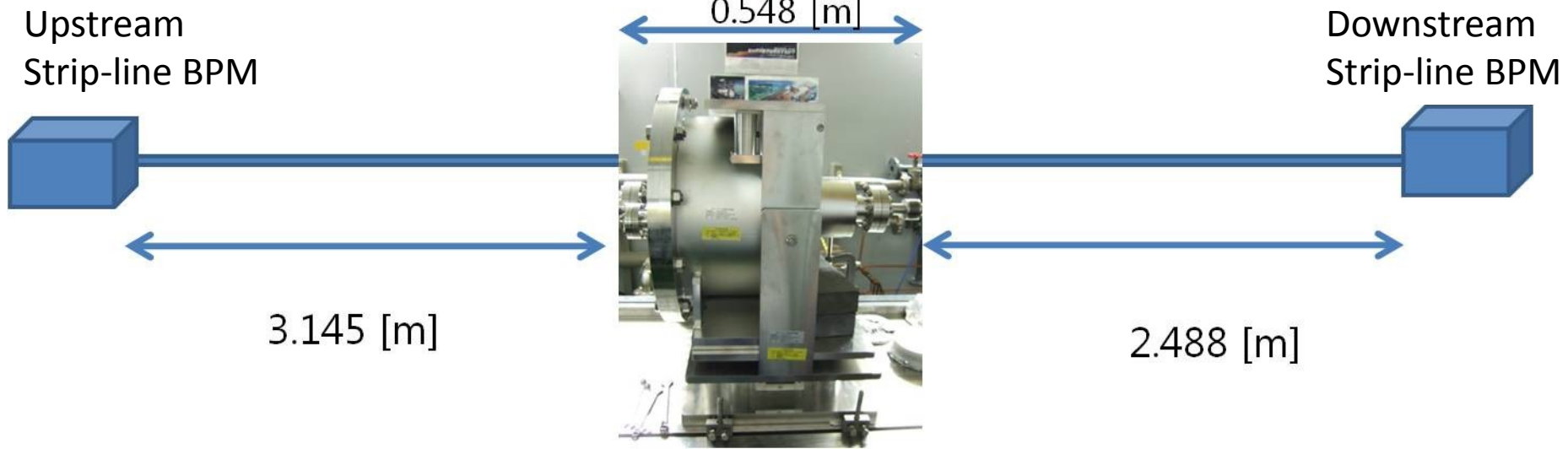
Signal cables



# Beam test set-up using two strip-line BPM

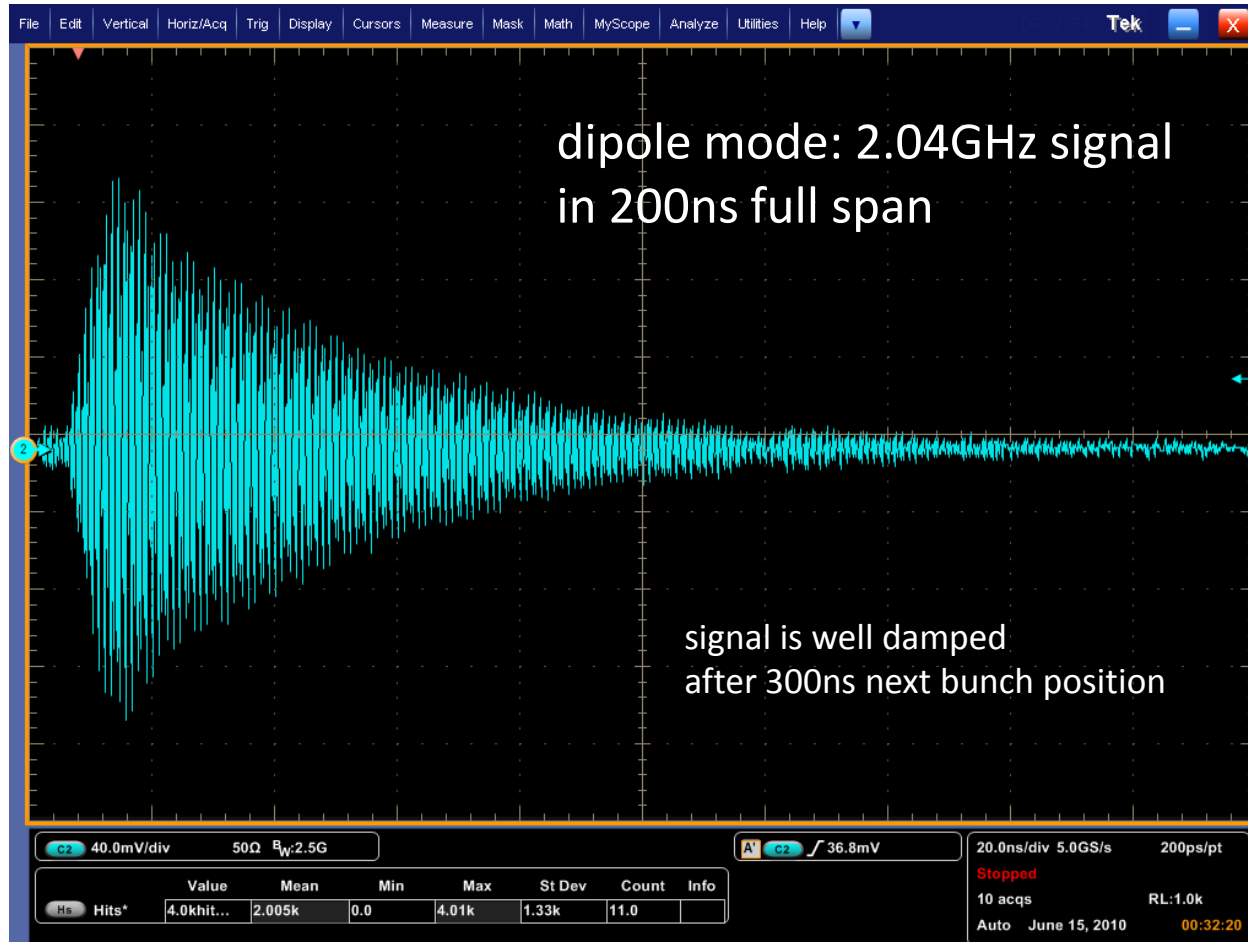


L-Band BPM is installed here

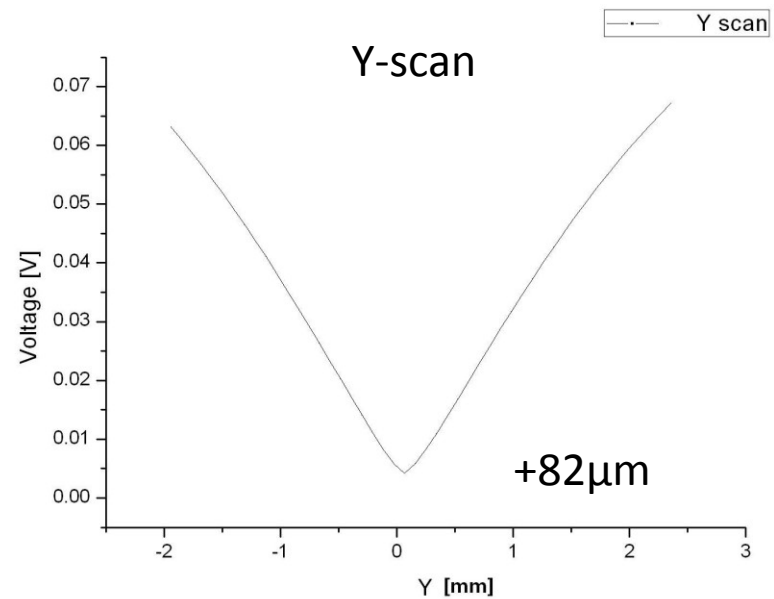
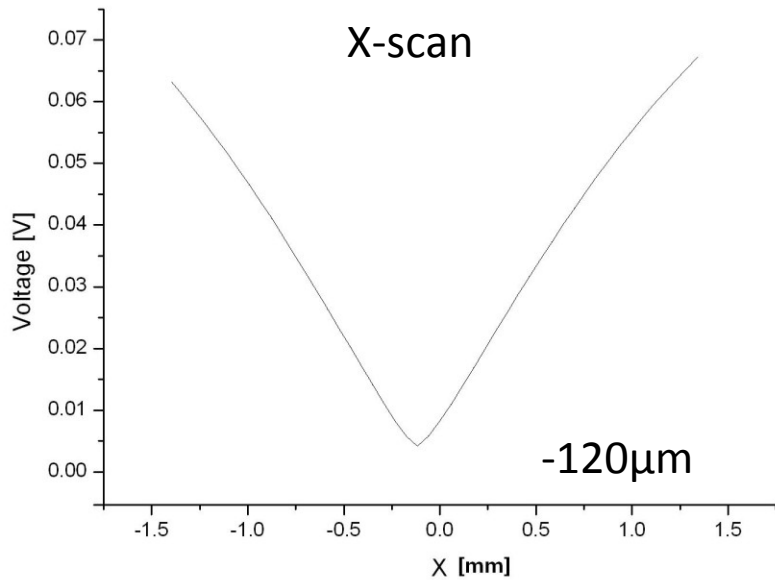
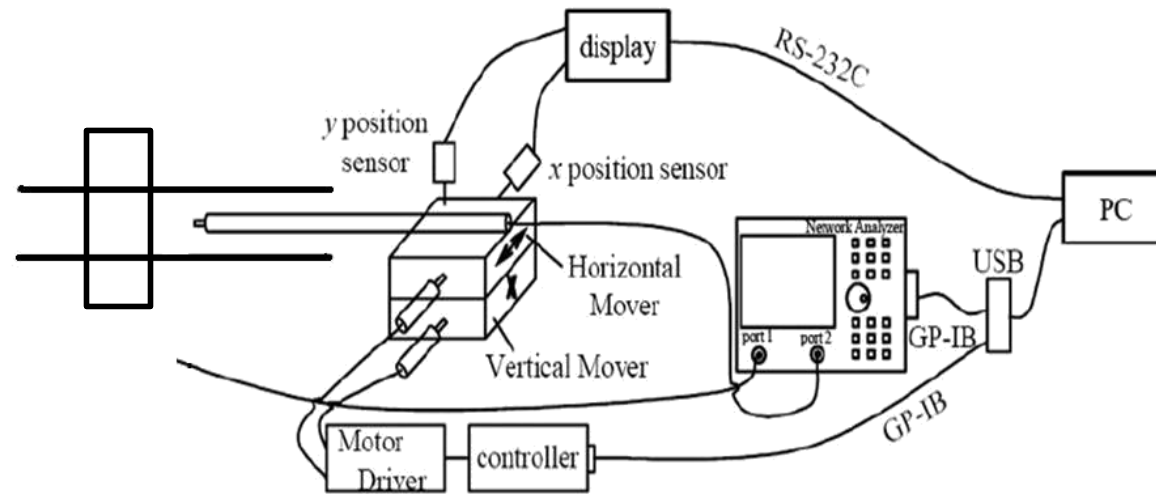


# Dipole signal from re-entrant BPM with Band-pass-filter

2.04 GHz signal with beam intensity  $0.5 \times 10^{10}$  electrons/bunch

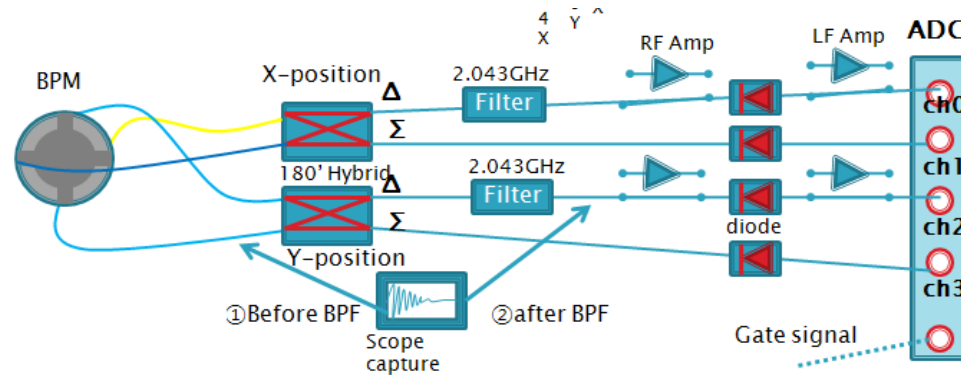


# Antenna scan for electrical center confirmation

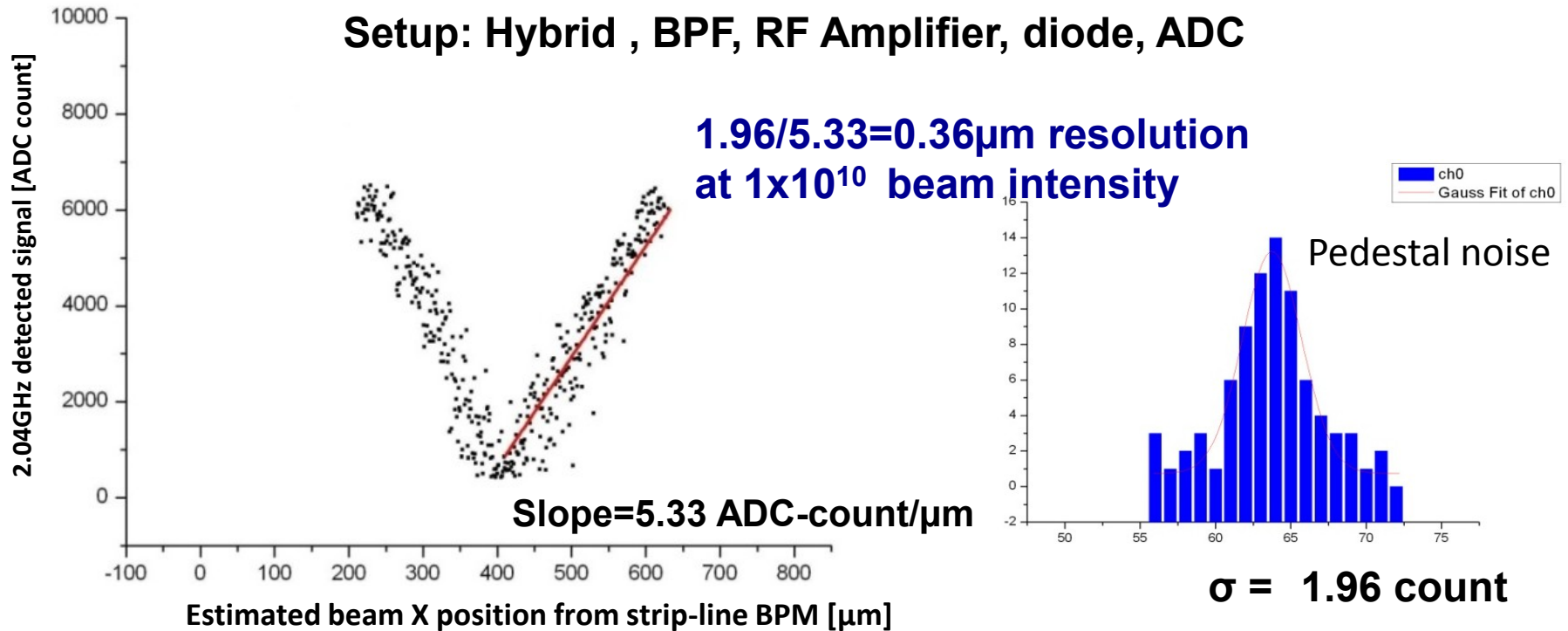




# Simple analog signal detection for resolution measurement



**Setup: Hybrid , BPF, RF Amplifier, diode, ADC**



## Summary of re-entrant BPM development

- (1) Re-entrant cavity BPM + cylindrical coupling wave-guide pickup was designed by HFSS.
- (2) Proto-type (building-block type) BPM was fabricated by stainless-steel.
- (3) Antenna scan was done to confirm small electrical center offset from mechanical center.
- (4) ATF beam test was done using simple electronics setup,  
and confirmed good position resolution less than  $1\mu\text{m}$  and small common-mode mixture.
- (5) Phase detection relative to the reference cavity signal was also tried.  
The results are still under analysis.

## Future Plan

- (1) Vacuum tight proto-type is under design and start fabrication.
- (2) Cool-down test and beam test at ATF are planned.
- (3) Installation into STF phase-2 CM1 in fall 2012, is a primary target.