

Development of ML-BPM for STF cryomodule

H. Hayano, KEK
SunYoung Ryu, PNU

History and Background

- **Development was started in 2005 for STF cryomodule BPM.**
- **T. Hino (M. student of Tohoku-Gakuin Univ.) for 2005-2006
(1st version of model BPM)**
- **SunYoung Ryu (M. student of Pusan National Univ. Her
teacher:Jung Keun Ahn, with connection to ILC-Asia
contact: Eun San Kim)
for 2007, She will continue the development for 2008-2010.
(2nd version of model BPM, then go to proto-type)**

Design Requirement

- High resolution ($< 1\mu\text{m}$ for single pass)
- Good fiducialization capability with respect to magnetic center (cylindrical outer, 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)
- No interference with cavity HOM(1.6-1.9GHz and $> 2.3\text{GHz}$)



Cavity BPM with 4 slots coupled;

high resolution, good fiducialization, withstand to thermal excursion

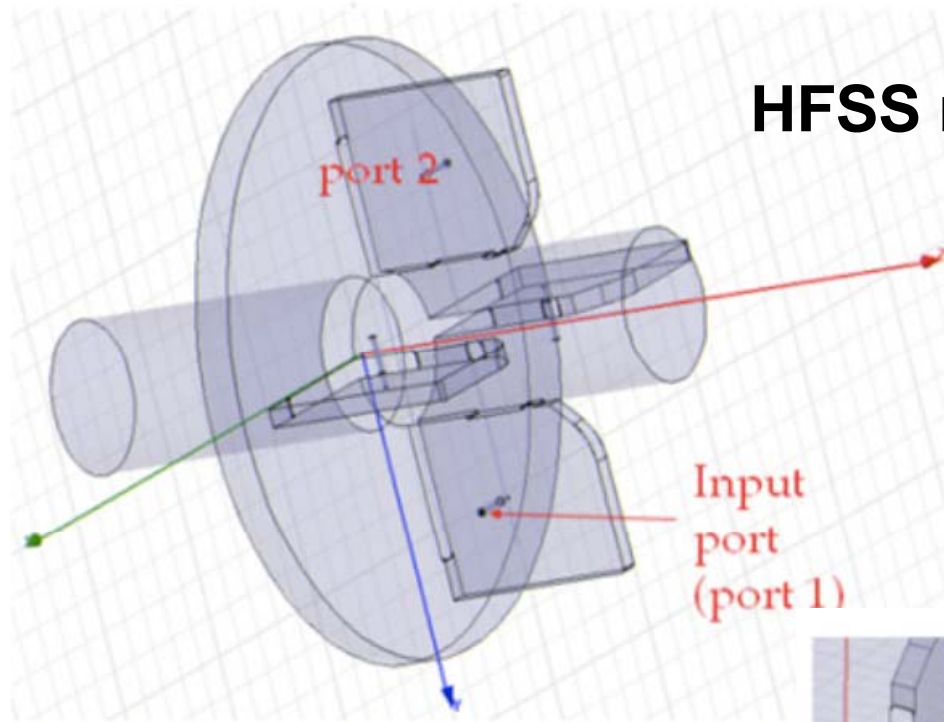
Use 2nd higher mode; match to big beam pipe, easy to get low QL

4 slots open to beam pipe; HPR washable

Drawback: Big size, heavy,

Feed-through are weak to HPR & thermal excursion

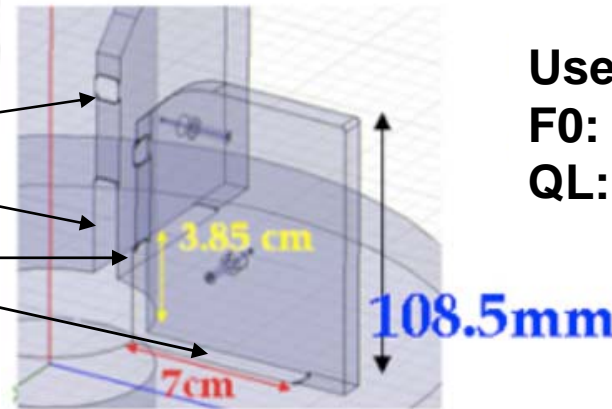
HFSS model of 2nd version



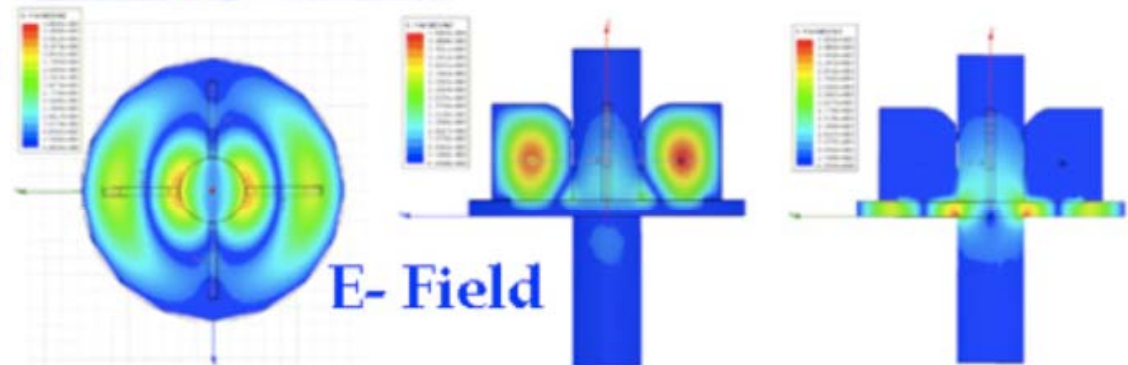
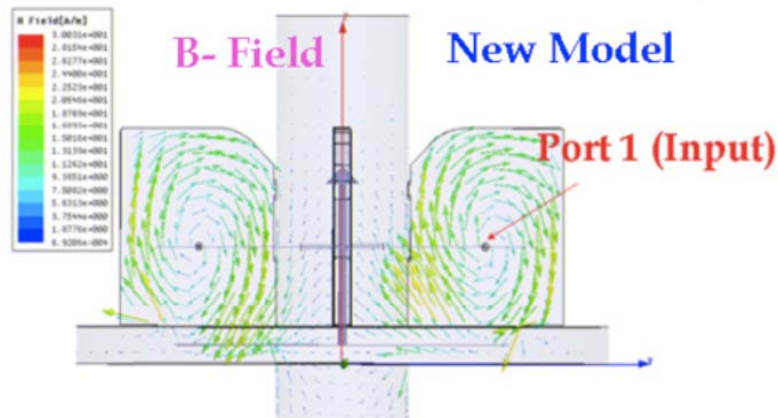
Cavity diameter: 312 mm
Cavity thickness: 20 mm
Slot width: 10 mm
Beam pipe diameter: 78 mm
Material: SUS

Slots for HPR wash

Coupling Slots

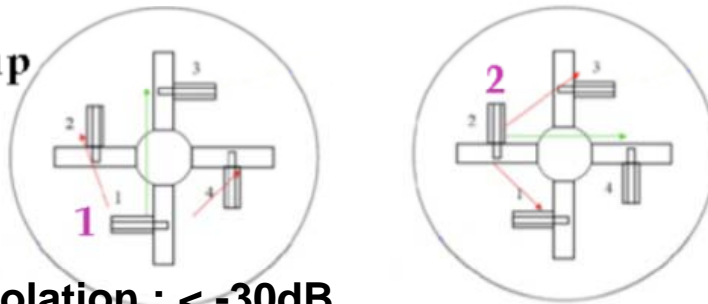


Used Mode: TM120
F0: 2.04GHz
QL: 260



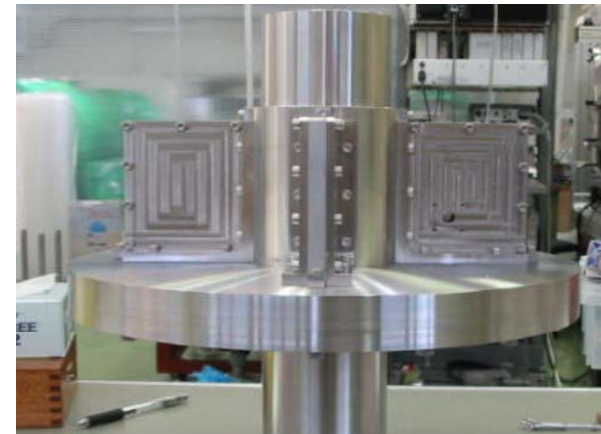
RF properties of Model BPM

Measurement Set-up

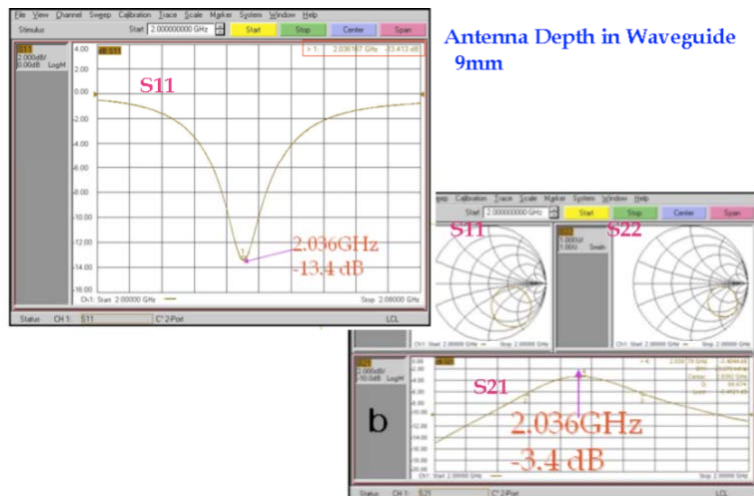
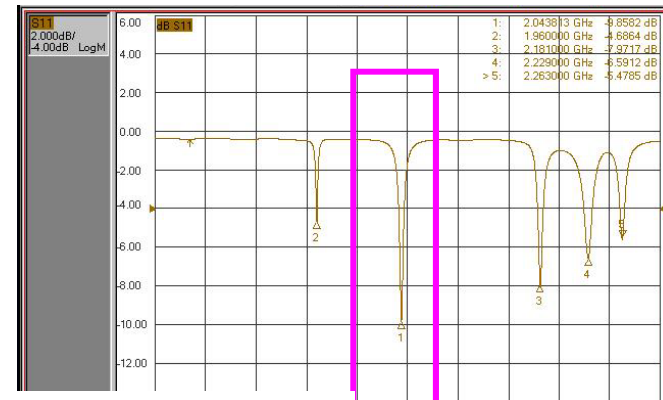


X-Y isolation : < -30dB

Port 1	Number	Isolation (dB)	Transmission (dB)
1	2	-30.327	、
	3	、	-3.08
	4	-40.749	、
2	1	-30.389	、
	3	-35.719	、
	4	、	-3.41

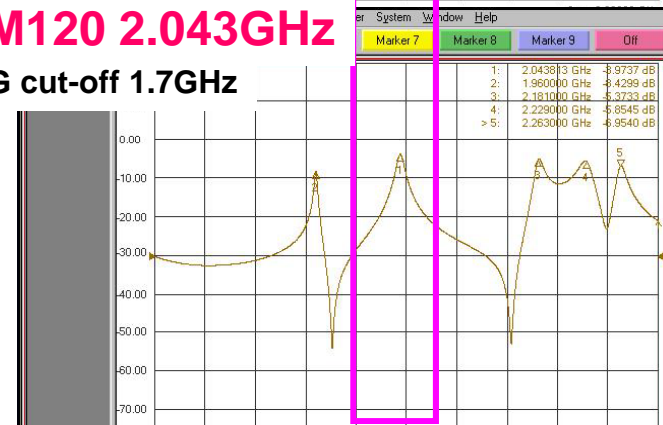


S11 & S21 on 1.8GHz ~2.3GHz



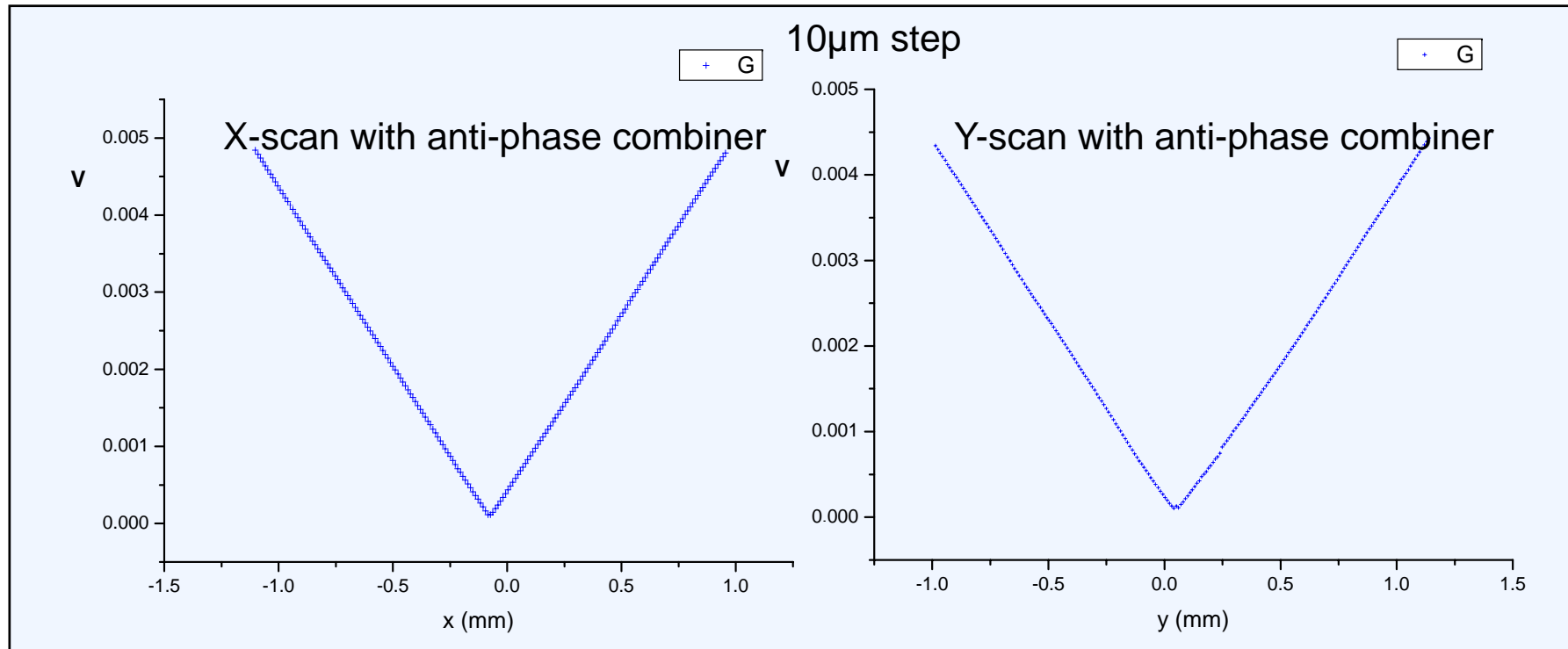
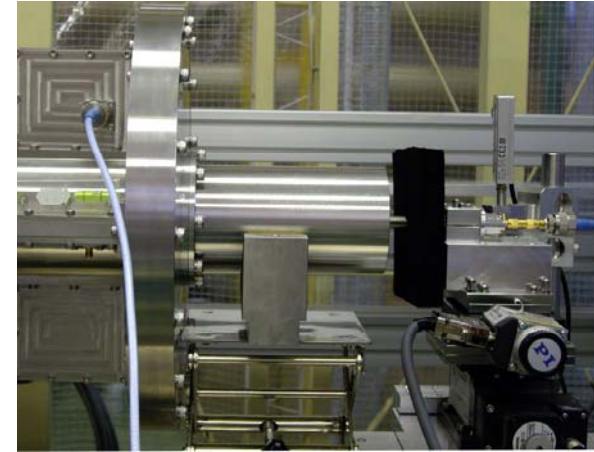
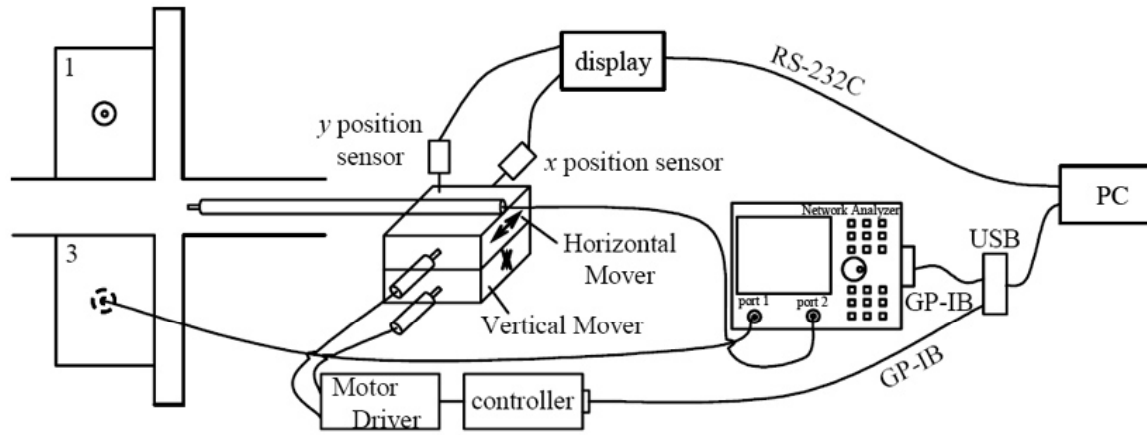
TM120 2.043GHz

WG cut-off 1.7GHz



How close to other mode signal : df=80MHz

Antenna Scan results



Schedule of Development

2008. Feb - May : preparation of beam test at ATF
using this model cavity in a big chamber.

2008. Jun : beam test at ATF Linac end.

2008. Feb - Jun: in parallel, design comparison with
Saclay BPM, FNAL BPM, SLAC BPM.

2008. Jun : Decision of design and direction of development

2008. July - : development feed-through connector.
design of vacuum tight BPM
design of electronics

2008. Fall : fabrication of vacuum tight BPMs (three of them)
(three-BPM method for resolution estimation)