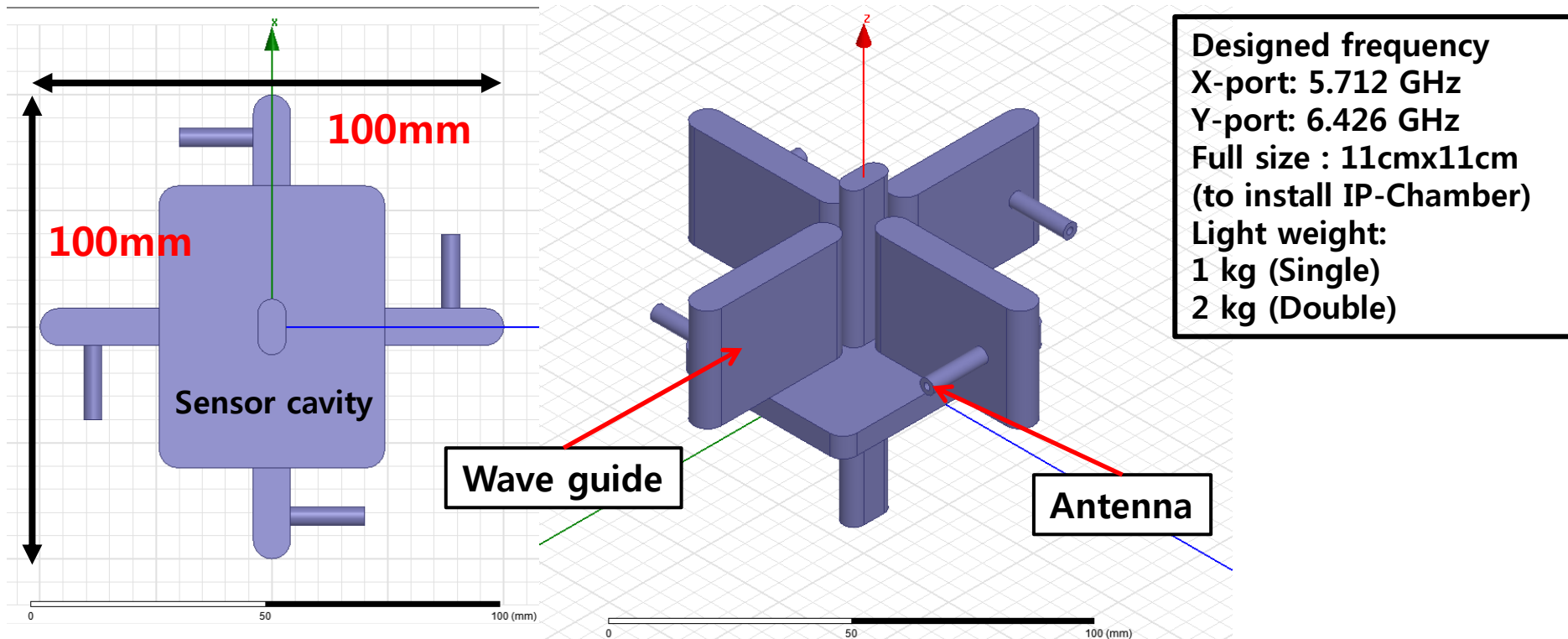# IPBPM test results at the LINAC end

KNU

Siwon Jang

Contents

- **New Low-Q IP-BPM design**
- **RF test of Low-Q IP-BPM**
- **Beam test of Low-Q IP-BPM**
- **Summary**

New Low-Q IP-BPM design

- ## 11cm Low-Q IP-BPM drawings of HFSS

100mm

100mm

Sensor cavity

Wave guide

Antenna

Designed frequency
X-port: 5.712 GHz
Y-port: 6.426 GHz
Full size : 11cmx11cm
(to install IP-Chamber)
Light weight:
1 kg (Single)
2 kg (Double)

Results of HFSS simulation

11cm AL ver.

Port	f_0 (GHz)	β	Q_0	Q_{ext}	Q_L	τ (ns)
X-port	5.7127	5.684	4959.29	872.42	741.91	18.72
Y-port	6.4280	5.684	4670.43	821.61	698.70	17.23

Output signal for Y-port (11cm AL ver.)

2nm offset
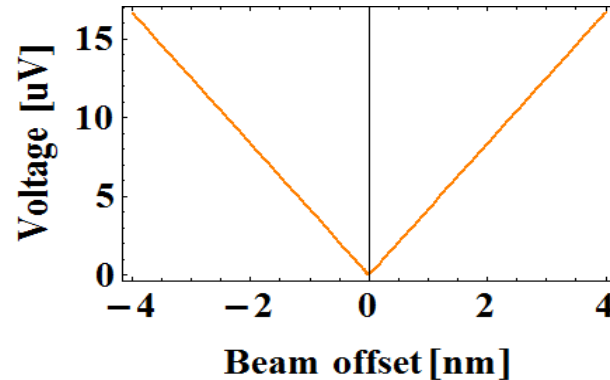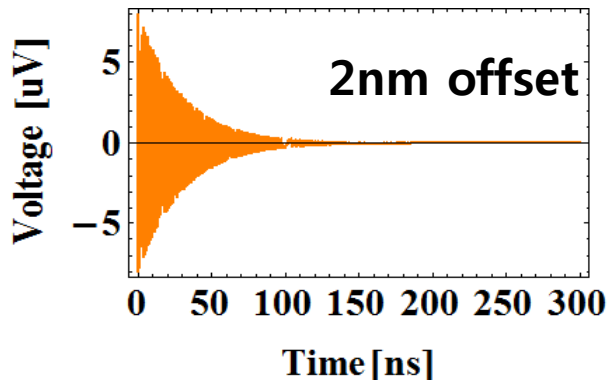
Parameter	Value	Unit
q (charge)	~ 1.6	nC
Beam energy	1.3	GeV
Bunch length	8	mm

New Low-Q IP-BPM

- **Made by Aluminum** (1kg for 1cavity)
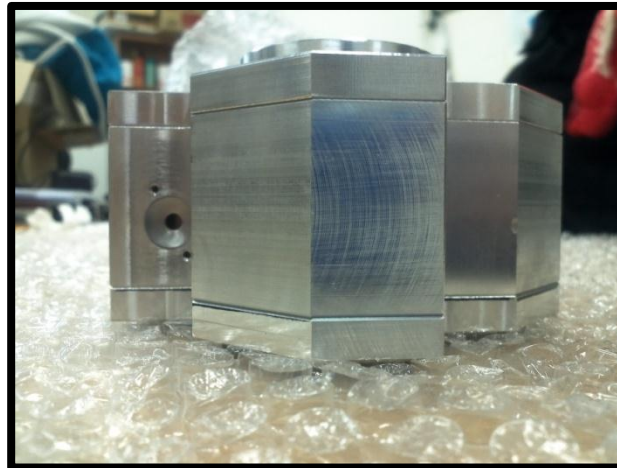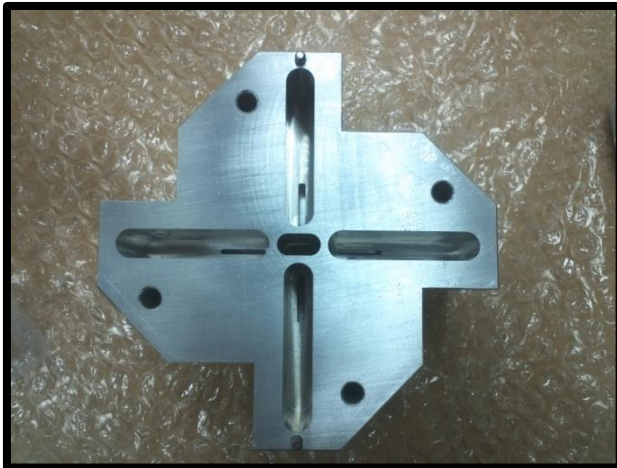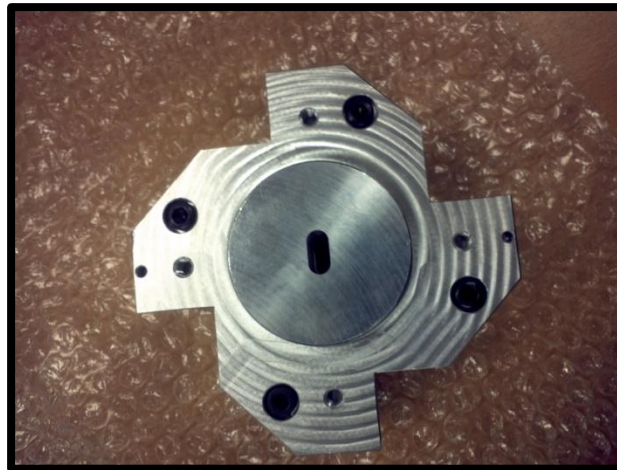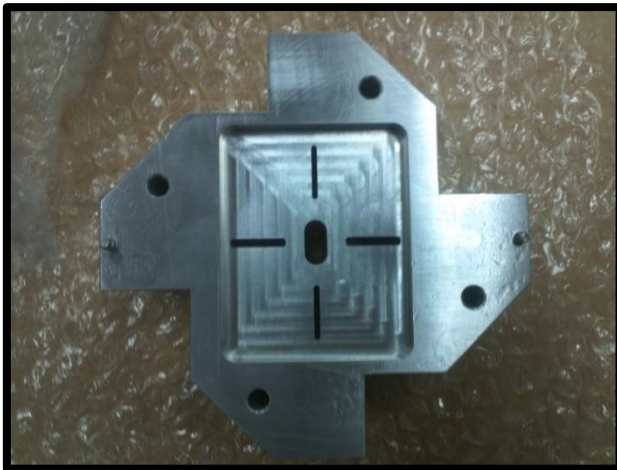
RF measurement data

	Port	f_0 (GHz)	β	Q_0	Q_{ext}	Q_L	τ (ns)	V_{out} [mV/um]
Designed	X-port	5.7127	5.684	4959.29	872.42	741.91	18.72	3.870
Designed	Y-port	6.4280	5.684	4670.43	821.61	698.70	17.23	3.724
Double_1	X-port	5.6968	0.656	362.34	552.14	218.77	6.112	4.870
Double_1	Y-port	6.4099	0.668	845.66	1266.7	507.11	12.59	3.005
Double_2	X-port	5.6975	0.817	483.38	591.45	265.99	7.430	4.705
Double_2	Y-port	6.4097	0.641	834.70	1302.5	508.70	12.63	2.964
Single_1	X-port	5.6991	0.855	502.05	587.04	270.61	7.557	4.722
Single_2	Y-port	6.4089	0.986	1238.0	1255.9	623.43	15.48	3.019

- Measured Q0 value shows too low for both x-port & y-port.

- Measured X-port data shows too strange, but output voltage shows little bit good.

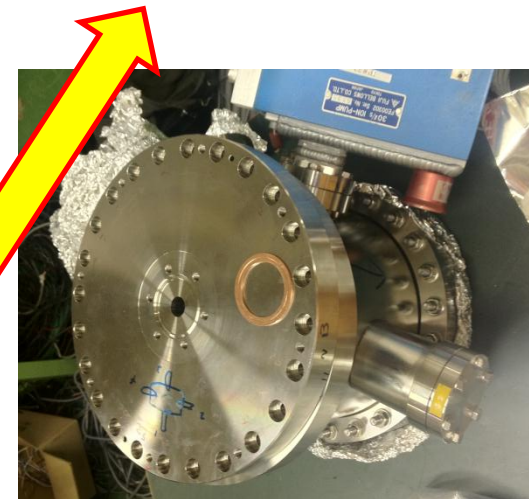- If possible I want to make one more set of Al IP-BPMs except volt type.

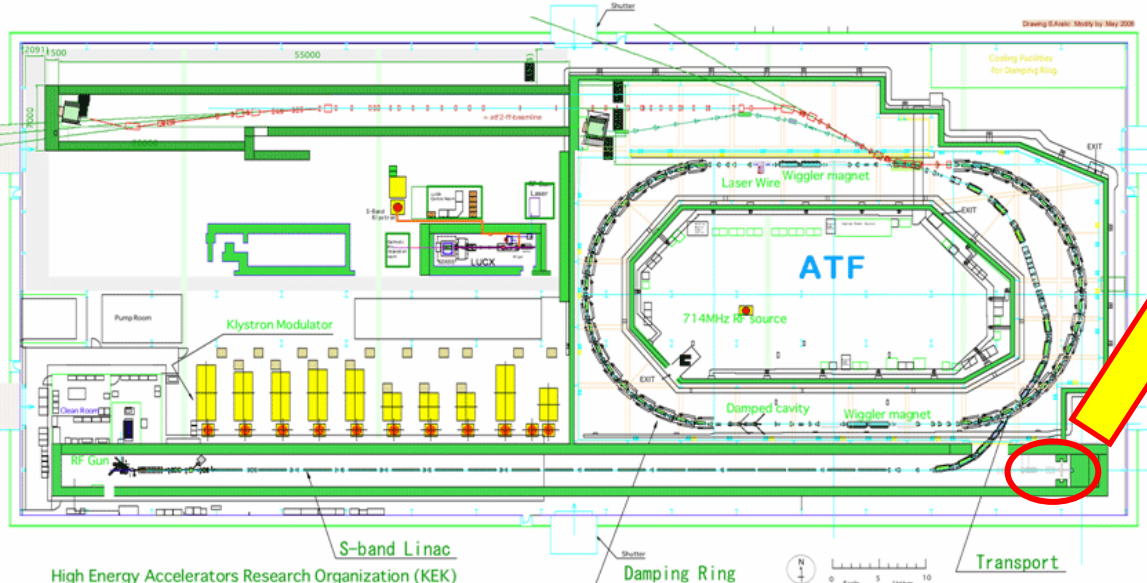# Low-Q IP-BPM Beam Test

- **Double block IP-BPM performance was tested at end of linac with old high-Q chamber.**
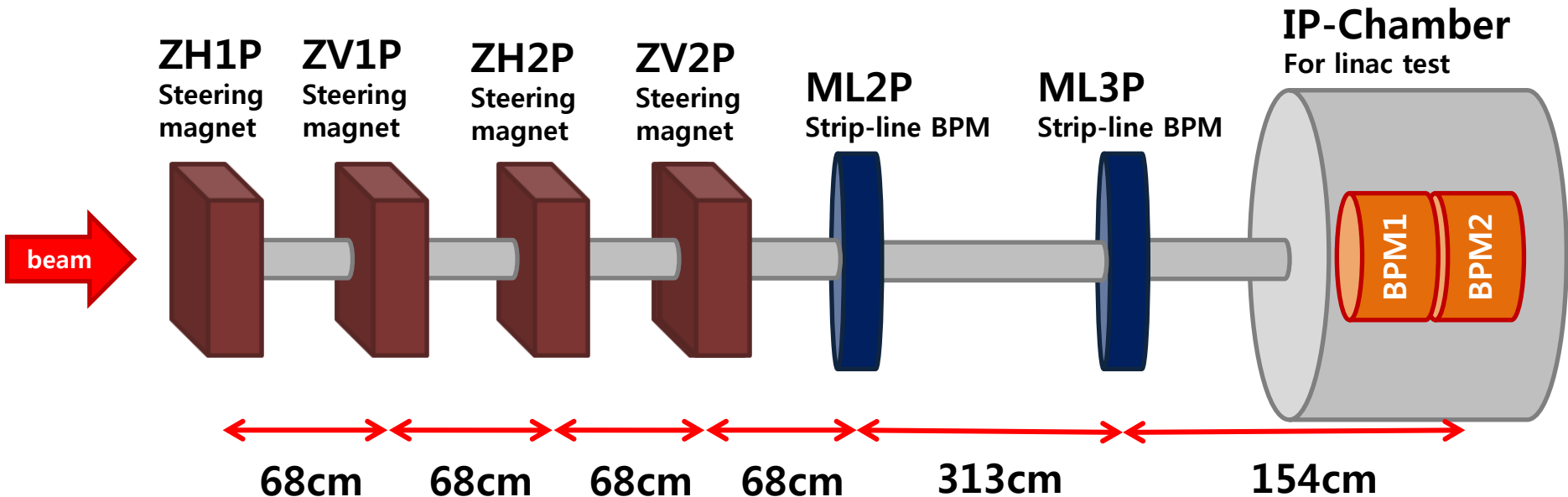
Old high-Q Chamber
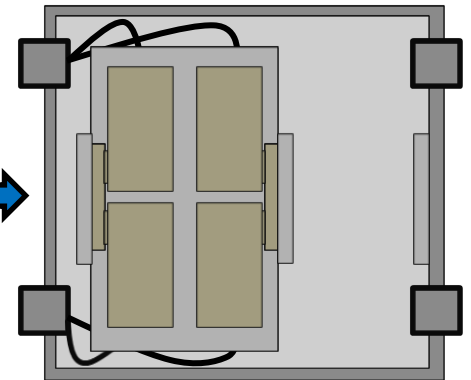
Beam →

ATF2 LAYOUT

Test scheme @ end of Linac

- ## Distance between each elements
  - **In that test, we used just one BPM (BPM2).**
  - **There is no more cables to connect BPM1.**
  - **Beam test performed during 4hours.** (Not enough to test other BPMs)

Results of IP-BPM y-port sensitivity

- **IP-BPM sensitivity**
  (For y-port)
  = **0.87631** [mV/um]

  (one-port measurements)

  = **2.27855** [mV/um]
  (one-port measurements &
  Consider the 8.3dB cable loss)

  *if we used two y-port of BPM, we would have the results 4.5571[mV/um].

  Designed sensitivity
  = **3.724** [mV/um] for two-port

  Test conditions
- 4 steering magnet (2 ver. + 2 hor.)
  => ZH1P, ZH2P, ZV1P, ZV2P
- 2 strip-line bpm
  =>ML2P, ML3P

  ICT monitor: 0.87 *10^10 (at LNE)

Equation	y = a + b*x		
Adj. R-Square	0.96335		
		Value	Standard Error
C	Intercept	-1177.45893	170.1318
C	Slope	2.27855	0.18086

Measured data
Fitting line

Results of IP-BPM x-port sensitivity

- **IP-BPM sensitivity**
  (For x-port)
  = **0.34146**[mV/um]
  (one-port measurements)
  = **0.88786**[mV/um]
  (one-port measurements & Consider the 8.3dB cable loss)

  *if we used two y-port of BPM, we would have the results 1.77572[mV/um].

  Designed sensitivity
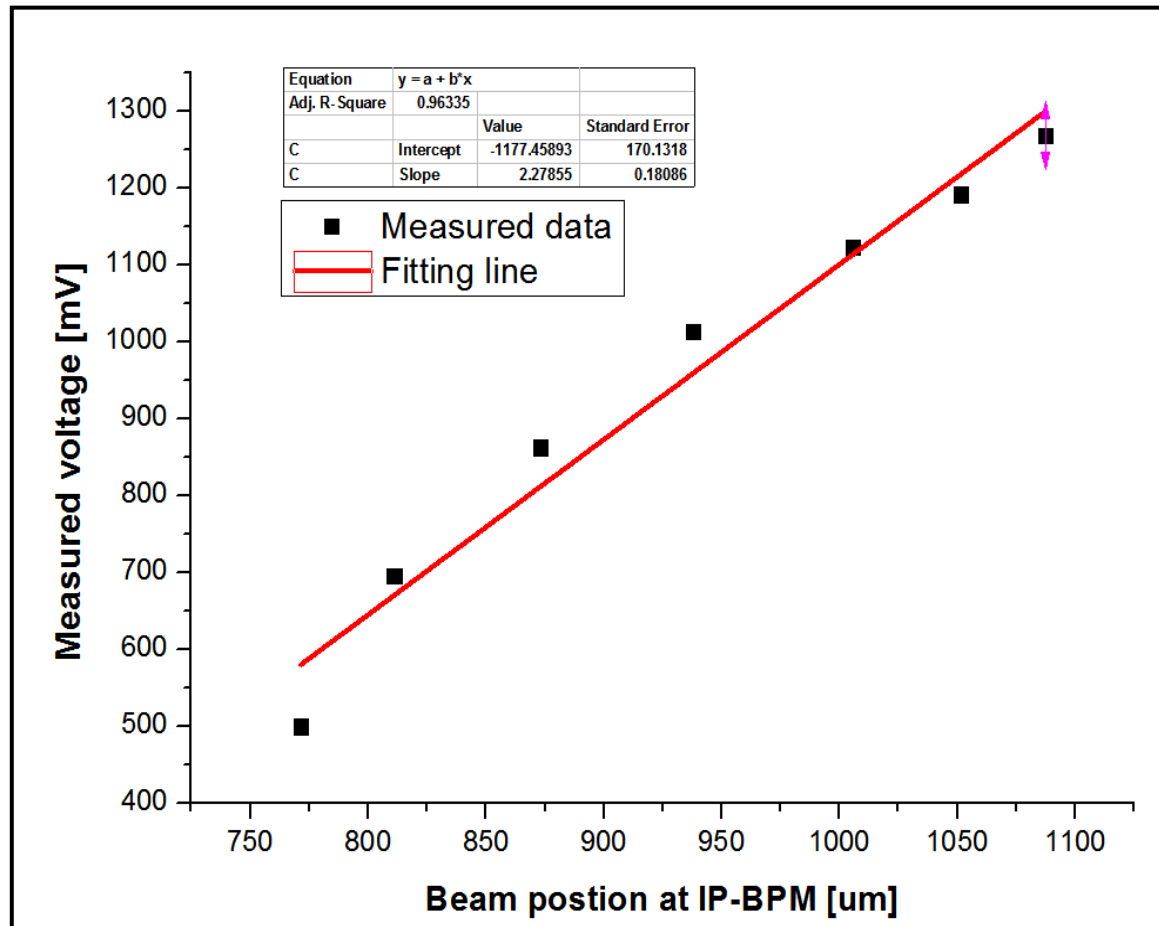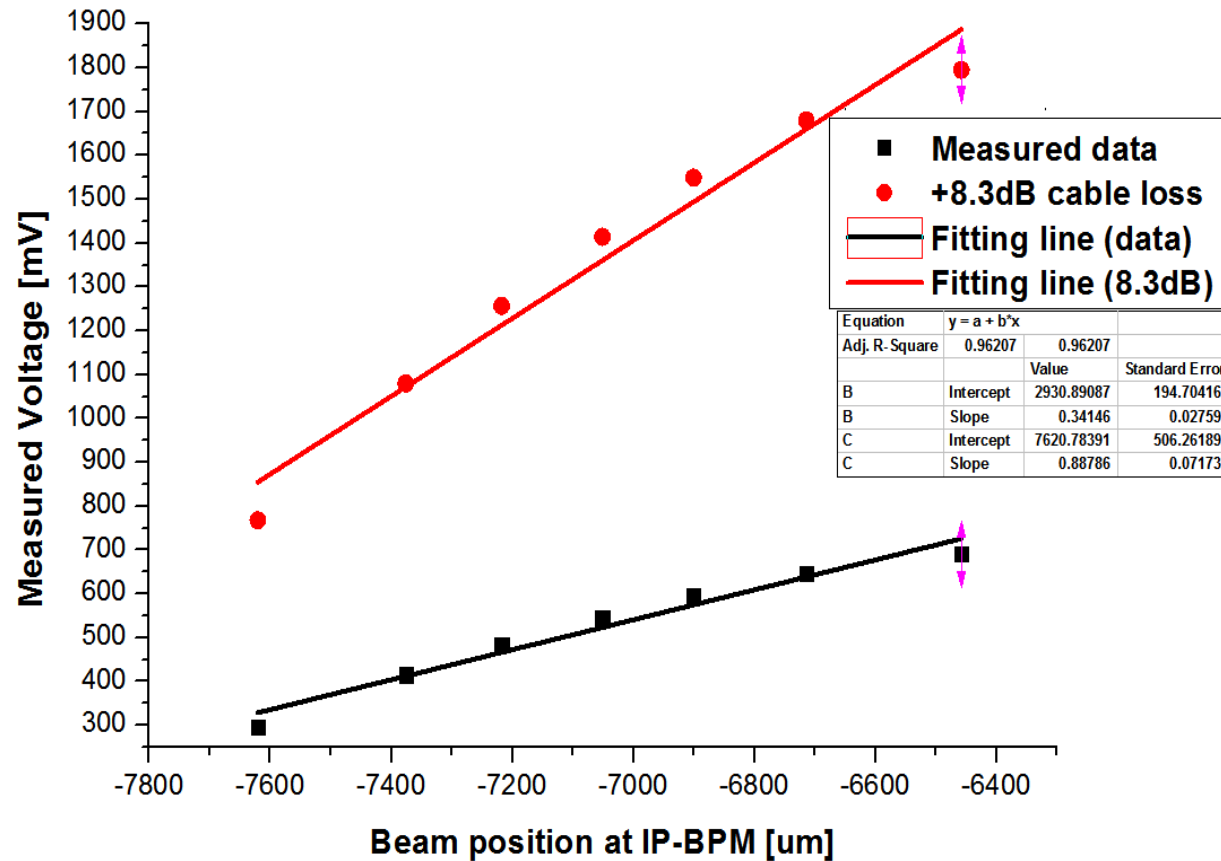 = **3.865**[mV/um] for two-port

  Test conditions
- 4 steering magnet (2 ver. + 2 hor.)
  => ZH1P, ZH2P, ZV1P, ZV2P
- 2 strip-line bpm
  =>ML2P, ML3P

  ICT monitor: 0.87 *10^10 (at LNE)

Equation	y = a + b*x		
Adj. R-Square	0.96207	0.96207	
		Value	Standard Error
B	Intercept	2930.89087	194.70416
B	Slope	0.34146	0.02759
C	Intercept	7620.78391	506.26189
C	Slope	0.88786	0.07173

Legend:
- ■ Measured data
- ● +8.3dB cable loss
- ▬ Fitting line (data)
- ▬ Fitting line (8.3dB)

Axis labels: Measured Voltage [mV] vs Beam position at IP-BPM [um]

Summary

- We tested new IP-BPM performance inside vacuum chamber at the end of Linac.

- The RF test results shows bad, but expected output voltage shows not bad.

- The beam test results shows quite good, Y-port results shows good performance. However, X-port results shows low performance less than expected value.

- When we discuss at France, the reason of low Q0 value seems caused by irregular surface of cavity. Therefore, the IP-BPM is polishing to check Q0 value again.