

LOW-Q IP-BPM ELECTRONICS

Siwon Jang (KNU)

Contents

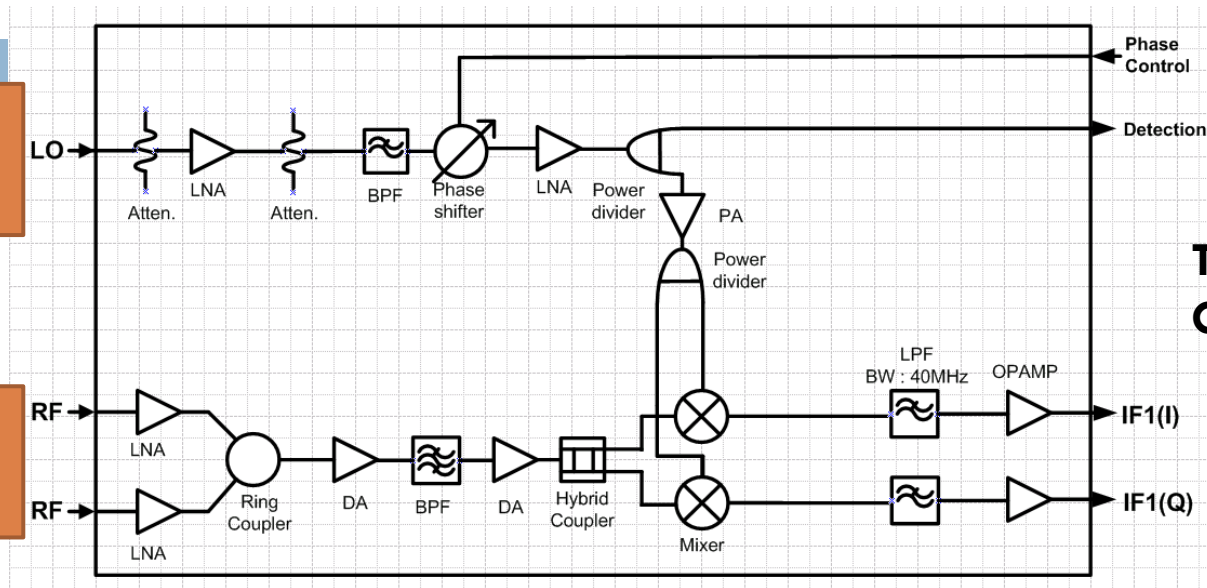


- **Spec of New electronics**
- **Test results of electronics on the beam line**
- **Modification of electronics**
- **Summary**

Simplified schematic of new electronics

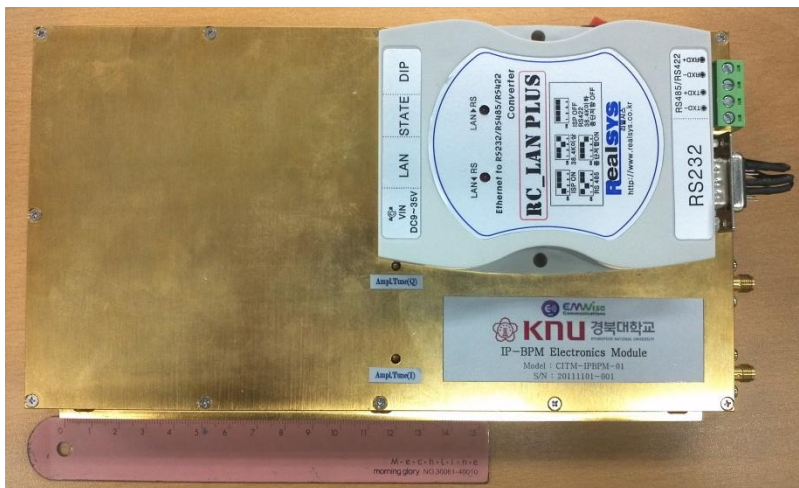
5.712GHz(X)
6.426GHz(Y)

5.712GHz(X)
6.426GHz(Y)



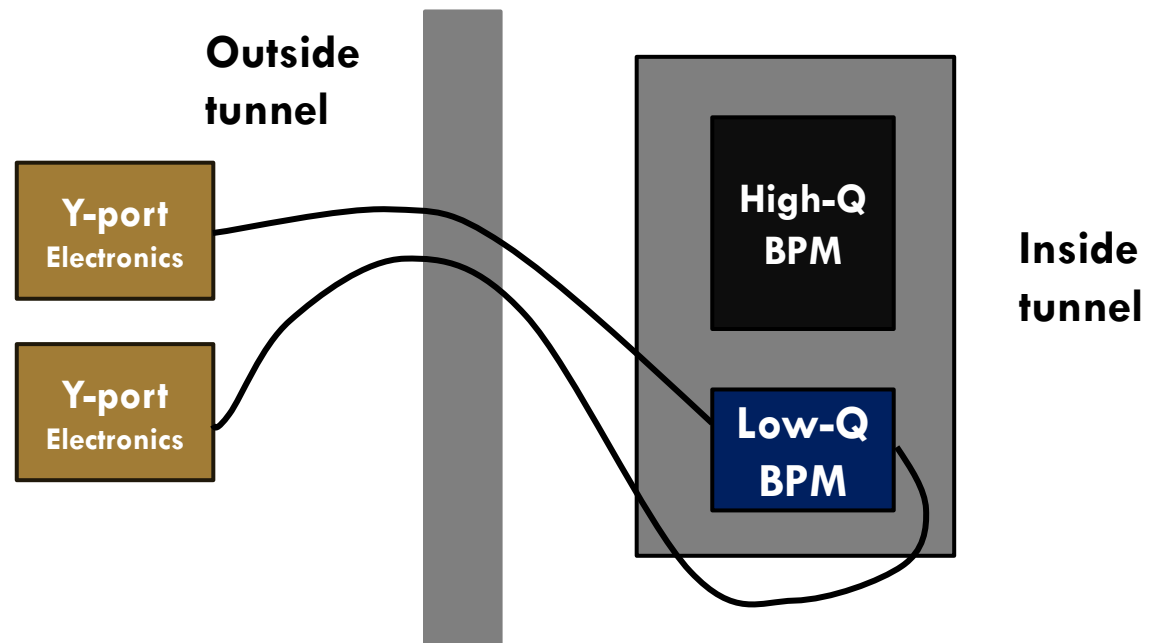
**Total conversion
Gain: 54dB**

Simplified schematic of the IP-BPM signal processing electronics.



Y-port electronics test (Jan.)

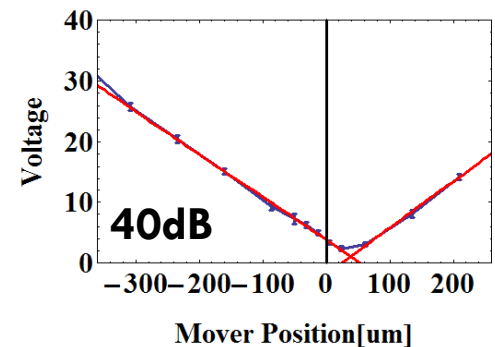
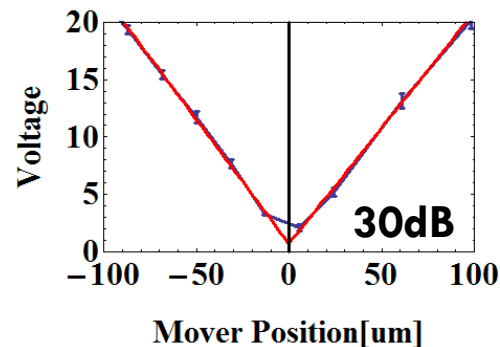
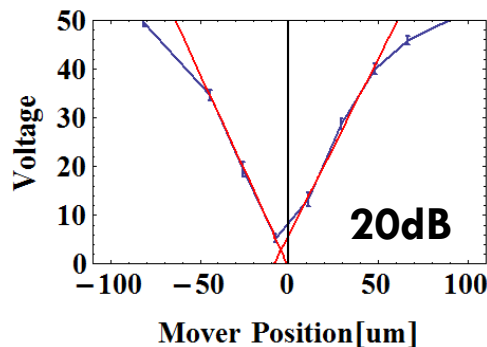
- We tested two Y-port electronics at the same time by using one Low-Q IP-BPM to check same performance of both electronics.
- Beam test scheme



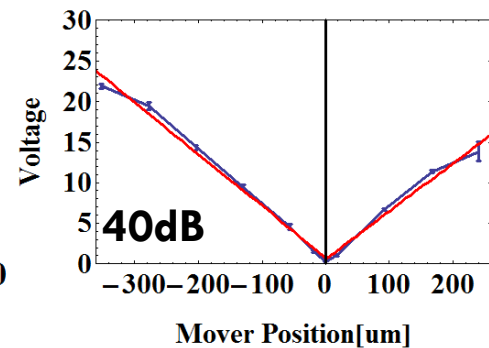
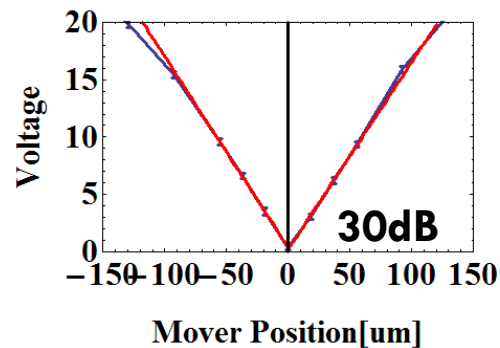
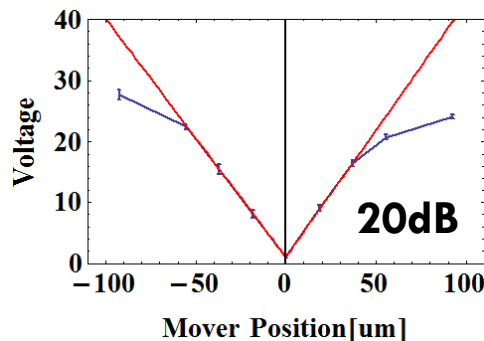
Results of Jan. beam test

- Calibration Run was made under 40 dB, 30 dB, 20 dB attenuation cases. This is to enlarge dynamic range of the electronics, in order not to saturate while sweeping the beam.

Y-port



Exchangeable Y-port



Results of Jan. beam test

- Calibration slope for calibrating the I signal to actual beam position is summarized in Table.

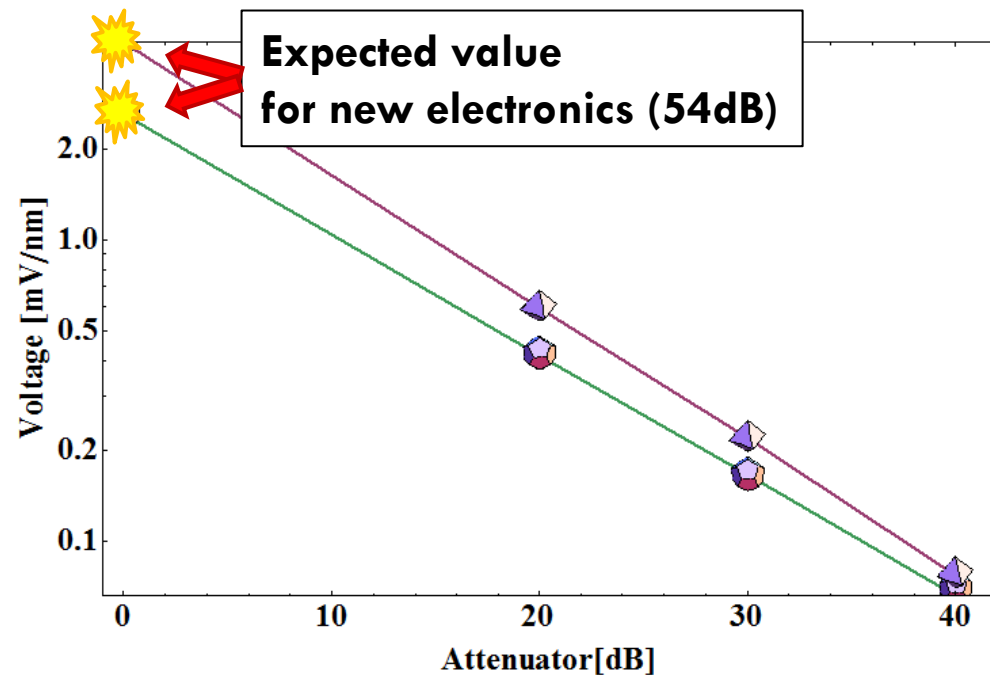
[mV/nm]	w/o	20dB	30dB	40dB
Y-port	4.509	0.721	0.218	0.077
Ex. Y-port	2.632	0.416	0.163	0.063

The results of calibration slope at the w/o att. case shows enough to measure 2nm resolution by using 14bit ADC ($\pm 1V$).

(14bit ADC noise = 366 μ V)

4509 μ V/nm = 37count/nm

2632 μ V/nm = 21.6count/nm



Modification of New electronics

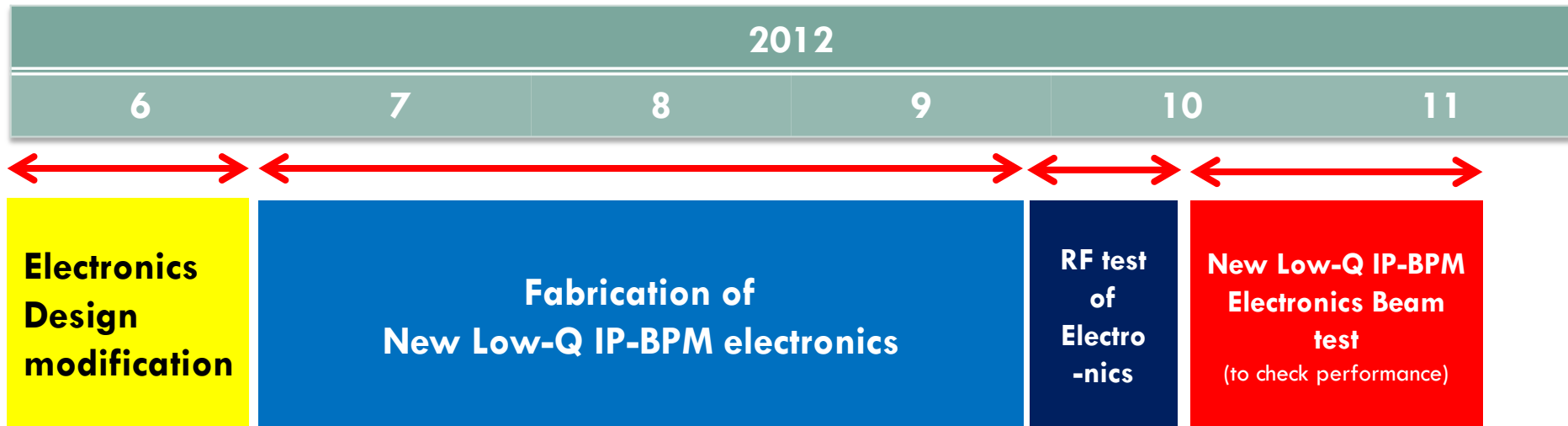
- If we use new electronics w/o modifications, then the dynamic range is too narrow. Therefore, we change the amplifier to reduce total conversion gain to 34~30dB.
 - For 54dB electronics ($\pm 1V$, 14bit ADC, waveform)
 - Expected limit resolution = Sub nanometer level (37 count/nm)
 - Expected dynamic range = 440nm (too narrow)
 - For 34dB electronics ($\pm 1V$, 14bit ADC, waveform)
 - Expected limit resolution = 1~2nm level (5~6 count/nm)
 - Expected dynamic range = ~3um
- Notice: 14bit ADC noise = 2~3 count

Modification of New electronics

- **Phase shifter: Digital voltage signal converter is adapted on electronics to control a phase shifter remotely.**
- **Reference signal detector installed inside electronics.**
- **I-Q signal phase difference on the mixer was modified more close 90 degree. (before, phase difference was 93 degree.)**

Fabrication schedule of electronics

- Existing one set of electronics modify will be done until August.
- Additional two sets of electronics will be fabricated until September.



Summary

- **We tested new electronics for 54dB conversion gain. Expected limit resolution was very low (below 2nm), but dynamic range was too narrow.**
- **Therefore, we should change the electronics amplifier to 34dB to reduce total conversion gain and to expand dynamic range.**
- **Some minor modification. (phase shifter, detector , ...)**
- **Three sets of electronics will be fabricated until Sep. and will test on Oct with Low-Q IP-BPM.**