Low-Q IP-BPM New electronics

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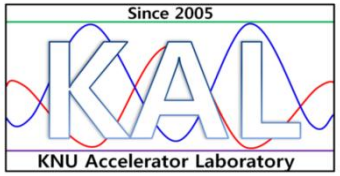

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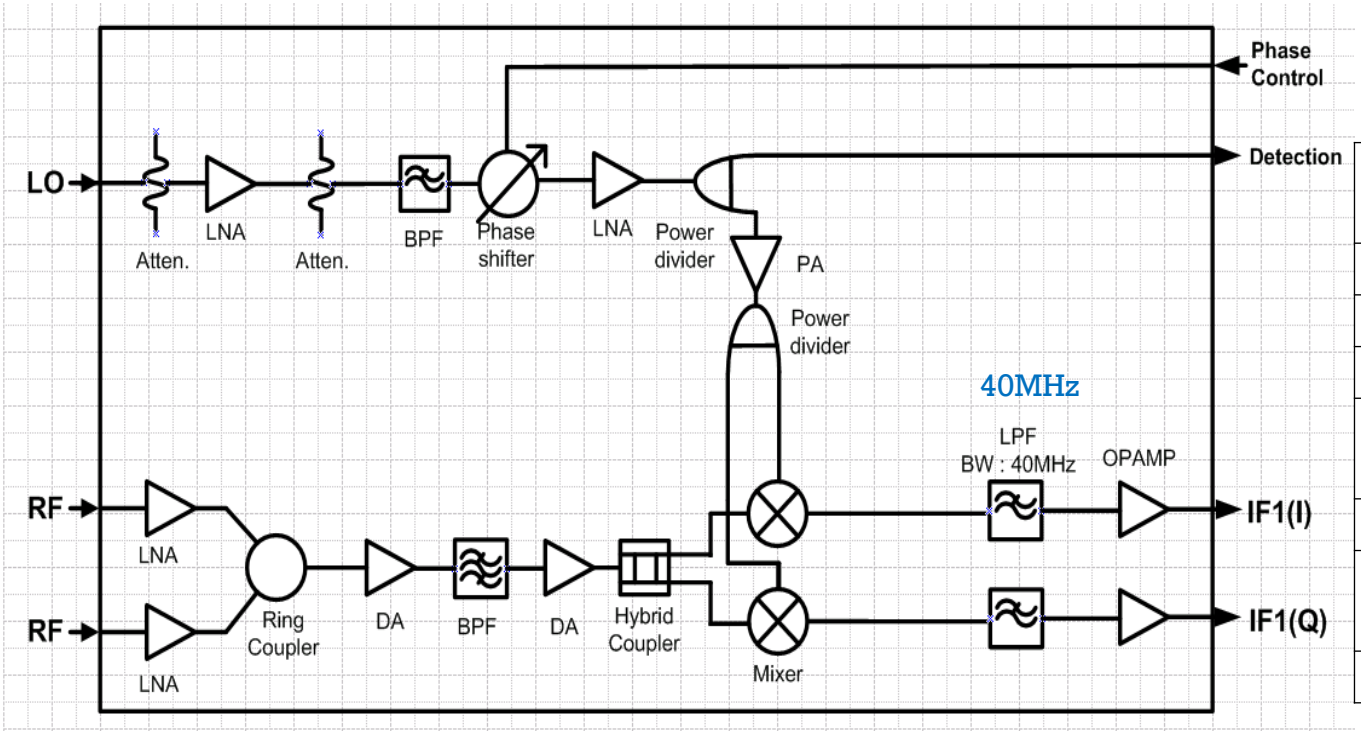
Characteristics of new electronics

- Single stage electronics (Single down conversion)
- Variable conversion gain: This is considered for installation position of electronics.
  - Inside tunnel: 44dB conversion gain will be used
  - Outside tunnel: 54dB conversion gain will be used (Cable loss: -9dB)
- Remote phase shifter: can control remotely in the control room
- Output voltage offset controller (for ADC): 300mV
- Shorter latency time : 25ns

Design of new electronics



	New electronics
BW of LPF	40MHz
Gain	54~44dB
Thermal Noise	-96.1dBm
Estimated Resolution due to thermal noise	2nm
Cascaded NF	1.88dB
RF $P1_{in}$dB	-22dB
Estimated Latency	25ns

- Conversion Gain : 54~44dB(X,Y)
- Variable OPAMP: 10dB
- BW of LPF : 40MHz
- Cascaded N.F : 1.88dBdB

- Remote phase shifter: 0 ~ 360 degree
- Estimated position resolution : 2nm
- Estimated Latency : 25ns

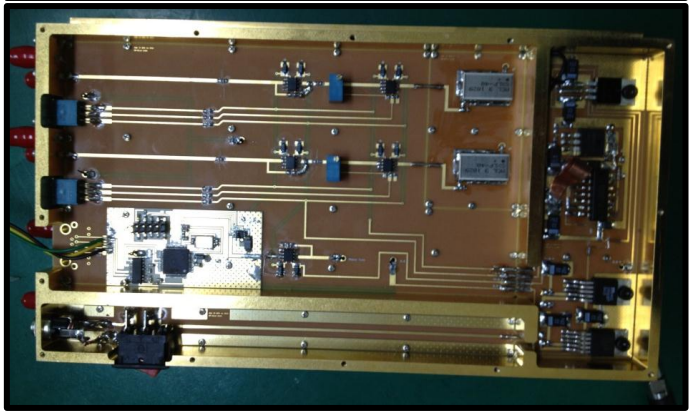
Spec. of new electronics

RF power -60.0[dBm]

Stage	Function	Gain [dB]	NF [dB]	P1dB [dBm]	Power	Part #	I [mA]
1	Ring Coupler	-3.0	3.0	100000000	-63.0	MS	
2	LNA	19.0	1.8	15	-44	HMC902LP3E	80
3	Ring Coupler	-3.0	3.0	100000000	-47	MS	
4	DA	19.0	1.8	15	-28	HMC902LP3E	80
5	Attem / Filter	-3.0	3.0	100000000	-31		
6	DA	19.0	1.8	15	-12	HMC902LP3E	80
7	Hybrid	-3.0	3.0	100000000	-15	MS	
8	Mixer	-7.0	7.0	0	-22	HMC129LC4	
9	LPF	-1.0	1.0	100000000	-23	SXLP-40+	
10	OPAMP	16.0	15.0	100000000	-7	OPA847	40
	Total Gain	**56.0**	**4.88**		-7	Toal Current	**280**

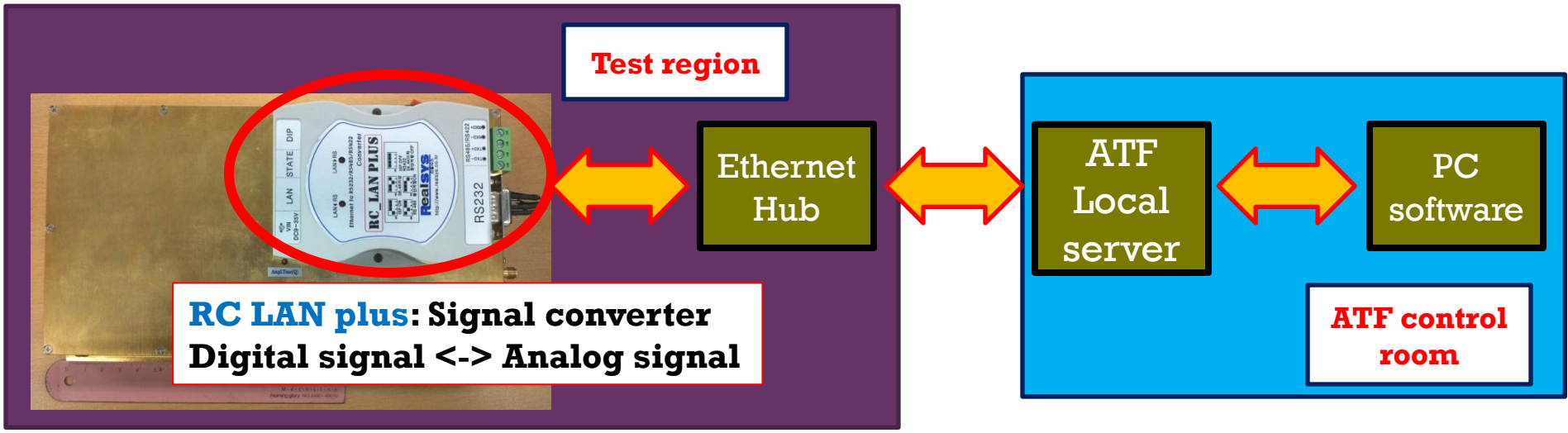
LO power 0.0 [dBm]

Stage	Function	Gain [dB]	NF [dB]	P1dB [dBm]	Pout	Part #	I [mA]
1	Atten.	-10.0	10.0	100000000	-10		
2	LNA	19.0	1.8	15	9	HMC902LP3E	80
3	Atten / BPF	-5.0	5.0	100000000	4		
4	Phase shifter	-4	4	6	0	HMC929LP4E	
5	LNA	19.0	1.8	15	16	HMC902LP3E	80
6	Power Divider	-3.0	3.0	100000000	13		
7	Medium PA	15.0	5.5	24	25	HMC407MS8G	230
8	Atten.	-3.0	3.0	100000000	22		
9	Power Divider	-3.0	3.0	100000000	19		
	Total Gain	**25.0**	**0.00**		19	Toal Current	**390**



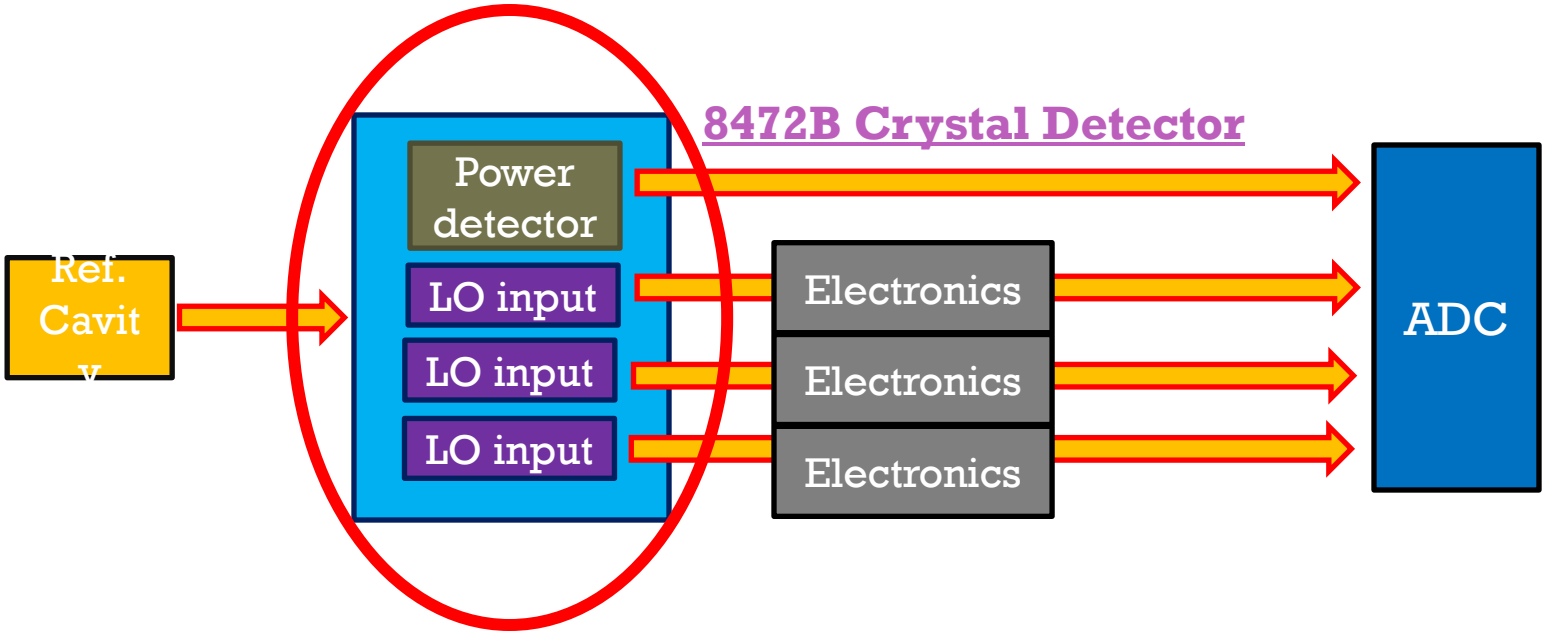
Remote phase shifter

- In November beam test, the phase shifter was controlled remotely at the ATF control room.
- The phase shifter was connected to RC LAN plus to control due to digital signal. The LO signal phase was controlled from 0 degree to more than 360 degree.



Power divider for Ref. signals

- The ref. cavity output is just one port, therefore the output signal should be split to connect LO signal port of each electronics and power detector.

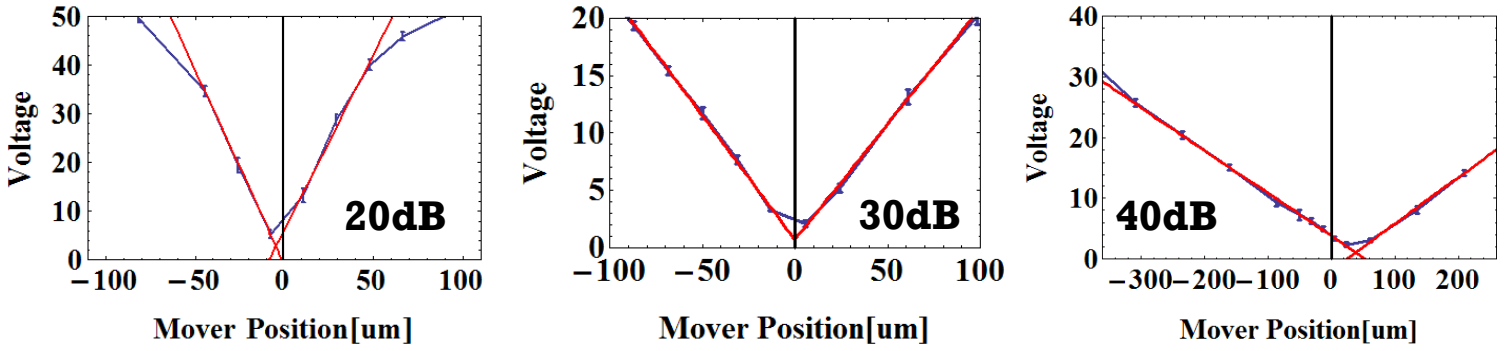


Now, on the fabricationing.

Expected performance of new electronics

- We can expect performance of new electronics by the results of beam test at last year.

Y-port



The results of calibration slope at the w/o att. case shows enough to measure 2nm resolution by using 14bit ADC.
(14bit ADC noise = 366uV, 3count)
450.9uV/nm= 3.7count/nm

[uV/nm]	w/o	20dB	30dB	40dB
Y-port	**450.9**	72.1	21.8	7.7

Results for 54dB gain electronics with old IP-BPM.

The expected dynamic range is more than 4.5um

To do things

For the future beam test, we should prepare some part.

- Variable remote attenuator: we should prepare variable remote attenuator to install inside tunnel.
  - Option 1: by using existing variable attenuator (Y.I. Kim)
  - Option 2: make new variable attenuator
- ADC system
  - Option 1: Integration mode ADC (Existing old one in the KEK)
  - Option 2: Waveform mode ADC (SIS3301, If we buy the new SIS3301 modules, can we use the create?)
  - Data taking program

Summary of electronics system

- New electronics was tested to get the optimized performance to achieve 2nm beam position resolution.
- The fixed points of electronics were total conversion gain, remote phase shifter and variable amplifier at the OPAMP.
- The expected beam position resolution by using new electronics was below 2nm with wide dynamic range and the time resolution of electronics was 25ns.
- We should prepare the variable attenuators and ADC system for the fast and stable data taking.