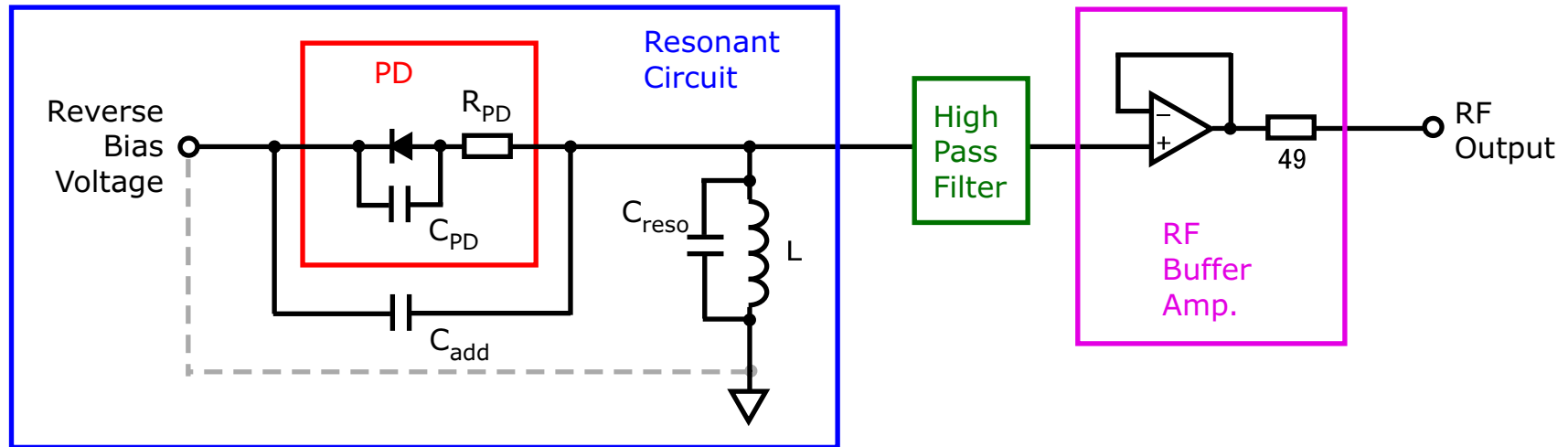
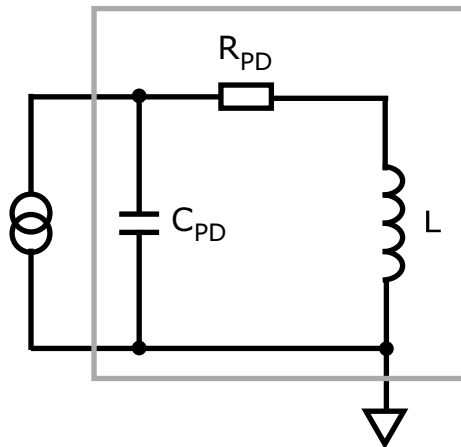


Basic Design of RF PD



Equivalent Circuit in RF
(simple case)



Resonant Freq.

$$f_0 = \frac{1}{2\pi\sqrt{LC_{PD}}}$$

Trans Impedance

$$Z(f_0) = \frac{L}{R_{PD}C_{PD}}$$

RF resonant PD (1)

	PD Intrinsic			Resonant Circuit			
	InGaAs Diode Aperture	Bias Voltage	PD Capacitor	Additional Capacitor	Resonant Capacitor	Resonant Inductance	Tunable Component
Mio (**)	Hamamatsu Photonics G3476-10 ϕ 1mm	+5V	37pF	22pF	(20pF)	1.5uH	C
Clear Pulse 8880	Hamamatsu Photonics G31071 ϕ 1mm	+5V	30pF	220pF	(20pF)	0.47uH	C
Akutsu 85MHz	PerkinElmer C30641G ϕ 1mm	+2V	40pF	none	33pF	(47nH)	L
Initial LIGO (*)	PerkinElmer C30642G ϕ 2mm		75pF	none	---	0.4uH	L

** Jpn. J. Appl. Phys, 40, (2001), 426-427

* LIGO document: D980454, P040032

RF resonant PD (2)

	High Pass Filter						
	Cut-off Freq.	Capacitor	Register or Inductor		RF OP amp.	Trans Impedance	Max.Optical Input Power
Mio (**)	329 kHz	220pF	R 2.2k		Unknown	1.23k Ω	131mW
Clear Pulse 8880	72.3 kHz	220pF	R 10k		AD8057		
Akutsu 85MHz	1.6 MHz	10nF	L 1uH		AD8001		
Initial LIGO (*)	410 kHz	100nF	L 1.5uH		MAX4107ESA	500 Ω	

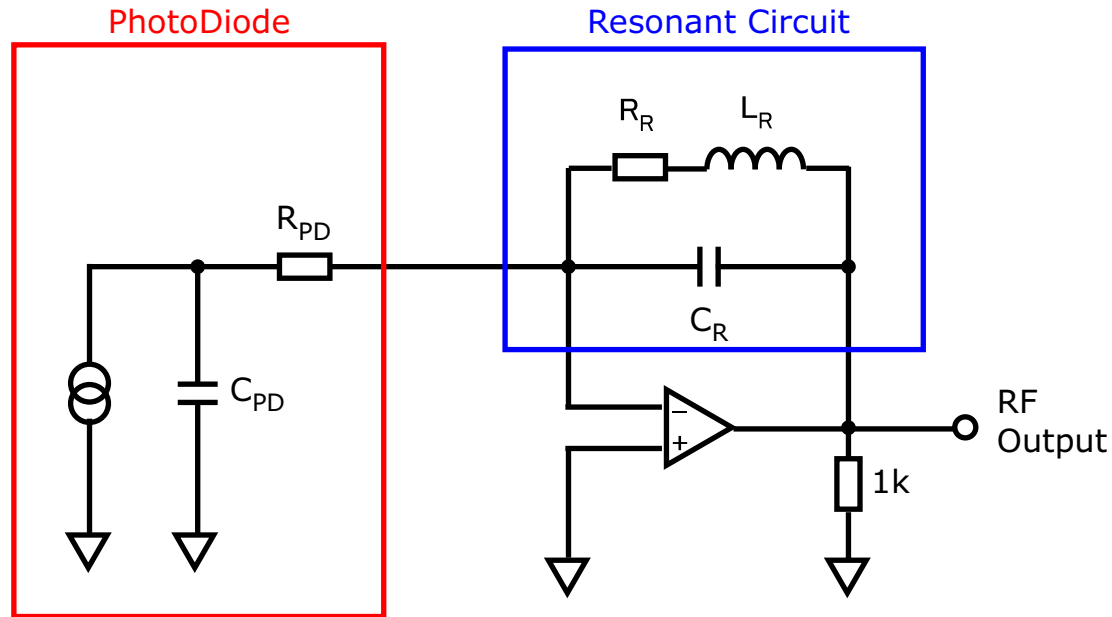
** Jpn. J. Appl. Phys, 40, (2001), 426-427

RF OP Amp.

	Bandwidth	Slew Rate	Output Current	Voltage Noise	Current Noise
AD8057	325 MHz G=+1	1000 V/us	2 mA	7 nV/sqrt(Hz)	0.7 pA/sqrt(Hz)
AD8001	880 MHz G=+1	1200 V/us	70 mA	2 nV/sqrt(Hz)	2 pA/sqrt(Hz)
MAX4107	300 MHz G=+1	300 V/us	30 mA	0.75 nV/sqrt(Hz)	2.5 pA/sqrt(Hz)

Variant circuit by R. Abbott

LIGO document: T060268



Resonant Freq.

$$f_0 = \frac{1}{2\pi\sqrt{L_R C_R}}$$

Trans Impedance

$$Z(f_0) = \frac{L_R}{R_R C_R}$$

$$f_0 < \frac{1}{2\pi R_{PD} C_{PD}}$$

R_{PD} や C_{PD} に依存しないで
tuning が可能なので便利

そもそも
これが満たせないなら
その Photodiode は
 f_0 周波数帯域で
使っちゃダメ。

Noise

$$V_{\text{noise}}^2 = V_n^2 + (I_n * Z(f))^2$$

V_n : voltage noise of OP amp.

I_n : current noise of OP amp.

問題点

DC output どうやって得るか？