Intensity stabilization sys tem of KAGRA

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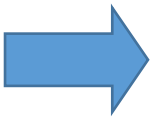
Contents

1. The requirements for bKAGRA

iKAGRA

Laser power:2W



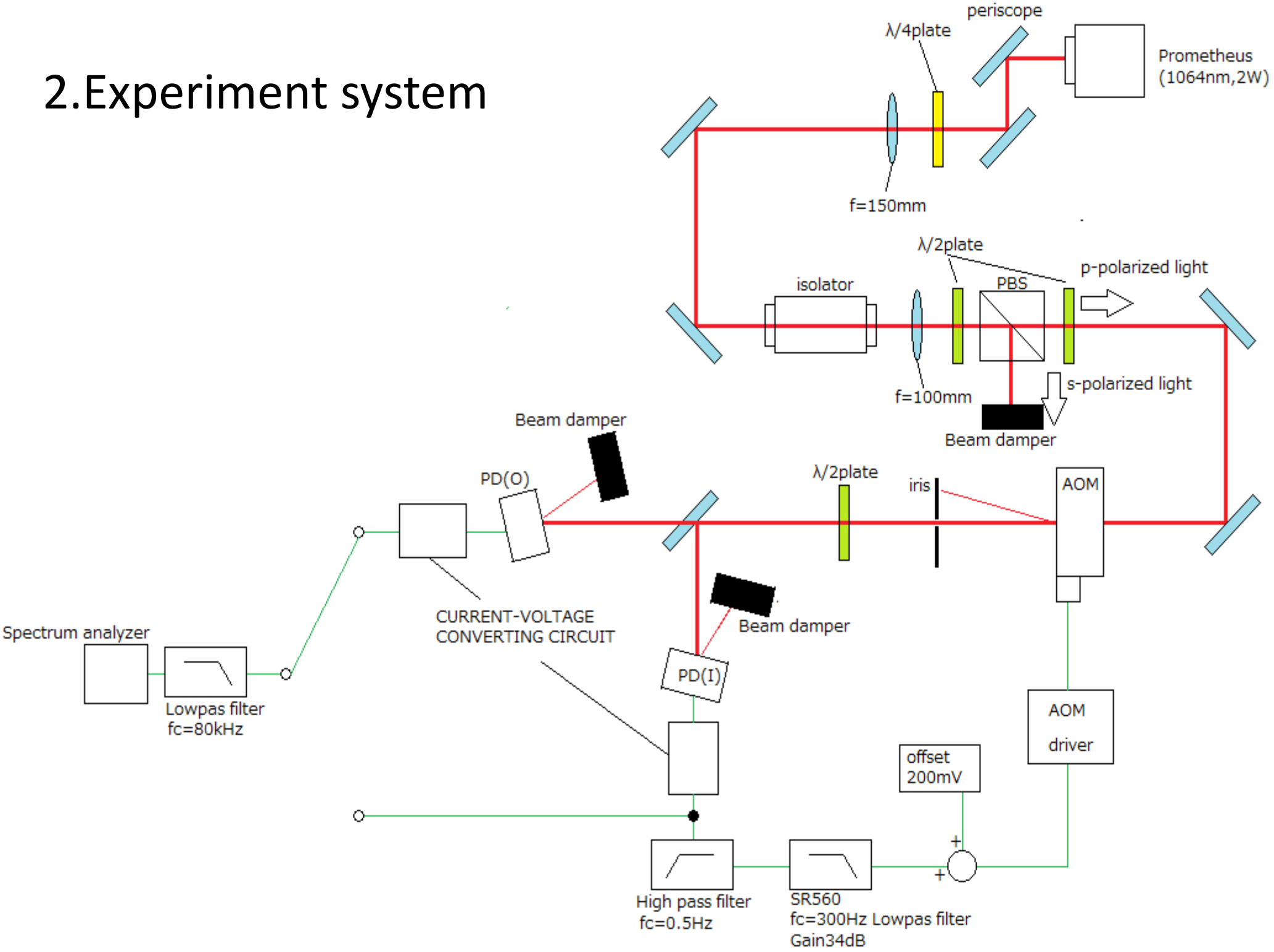
bKAGRA

Laser power:~200W

- Test mass is pushed by the radiation pressure. So laser intensity fluctuations lead to vibrational fluctuations of test mass.

- The requirements on relative intensity noise of the laser are $2 \times 10^{-9}/\sqrt{\mathrm{Hz}}$ @30Hz , $1\times 10^{-8}/\sqrt{\mathrm{Hz}}$ @100Hz.

2.Experiment system



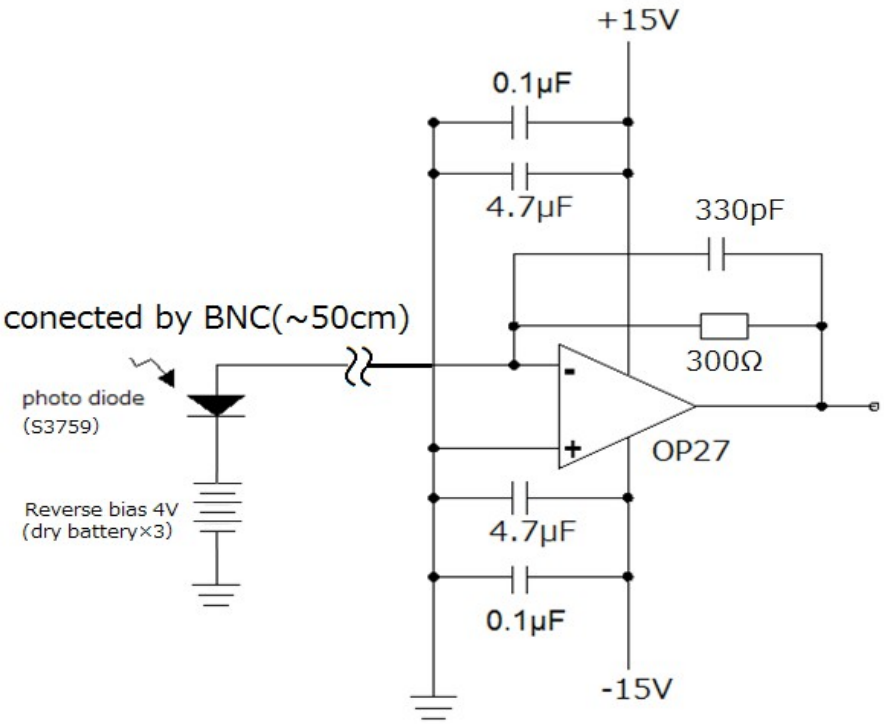
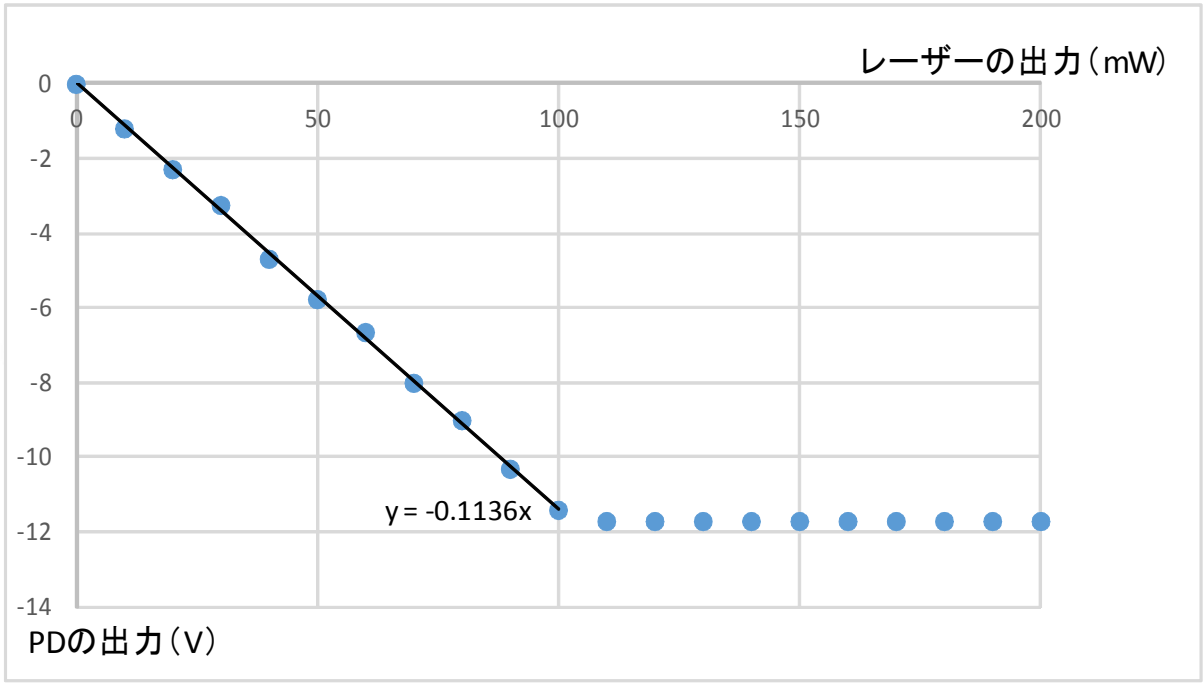


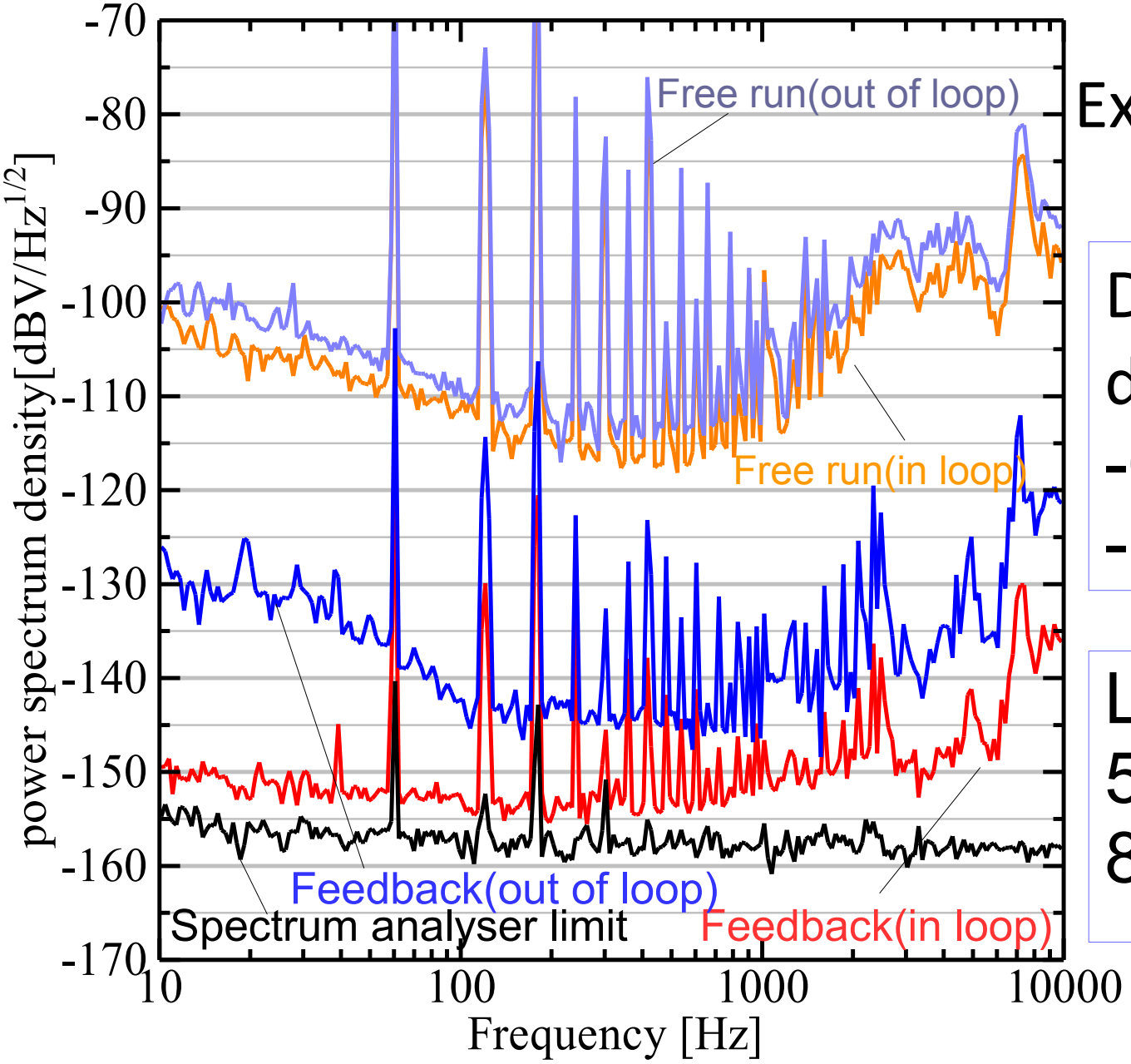
figure of PD



linearity of PDs signal

	Previous	Present
Laser	Mephisto2000NE	Prometheus
Diameter of PD	1mm	5mm
Gain of SR560	40dB	34dB
Control band	~30Hz	~300Hz
Incident power	~55mW	~80mW

3.Result

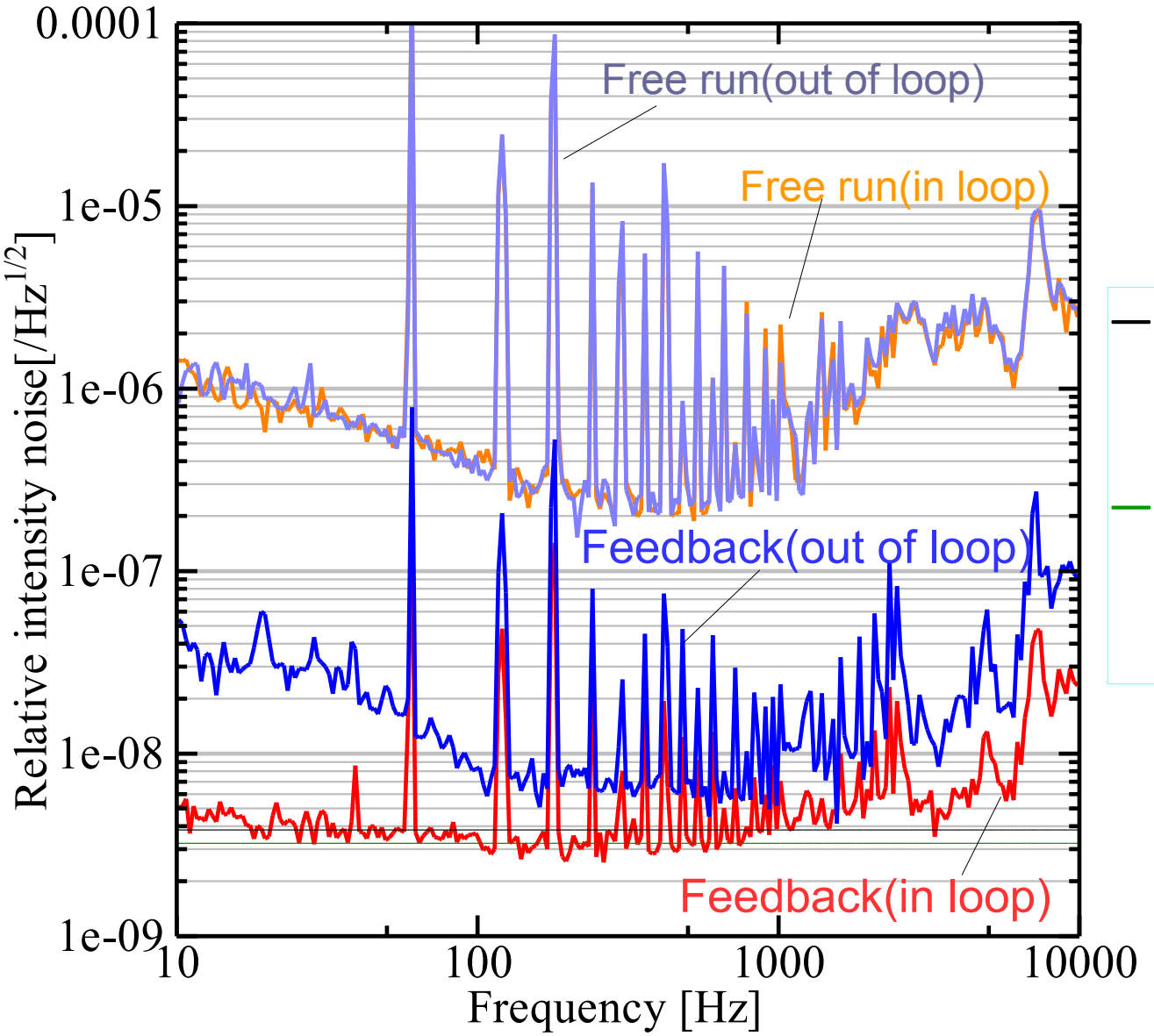


Experimental condition

DC signal from detector
-6.6V(PD(I))
-9.2V(PD(O))

Laser power
57.9mW(PD(I))
80.7mW(PD(O))

3.Result



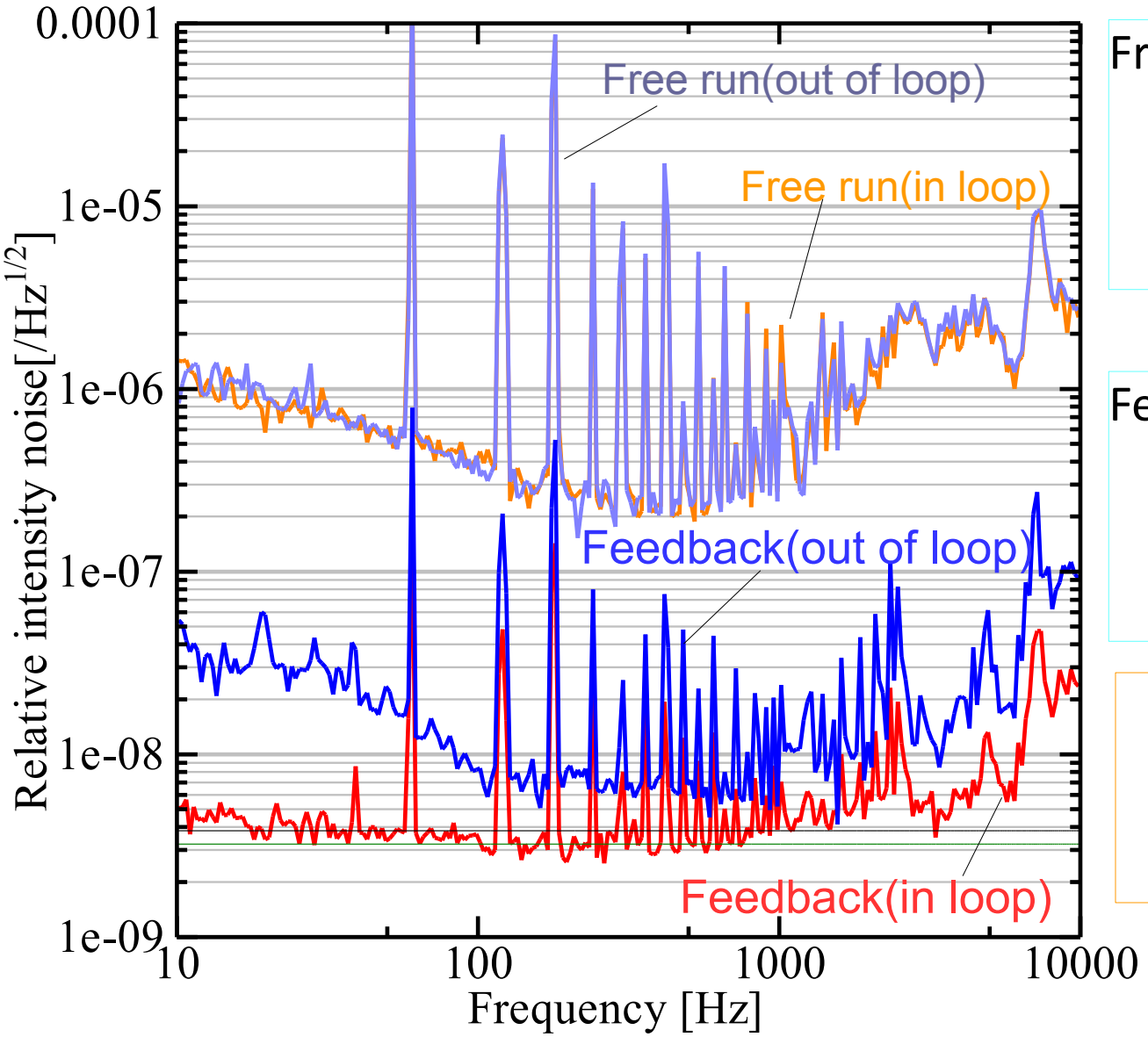
—relative shot noise(in loop)

$3.8\times10^{-9}/\sqrt{Hz}$

—relative shot noise(out of loop)

$3.2\times10^{-9}/\sqrt{Hz}$

3.Result



Free run(without control)

7.7×10^{-7}/√Hz @30Hz

3.3×10^{-7}/√Hz @100Hz

Feedback(with control)

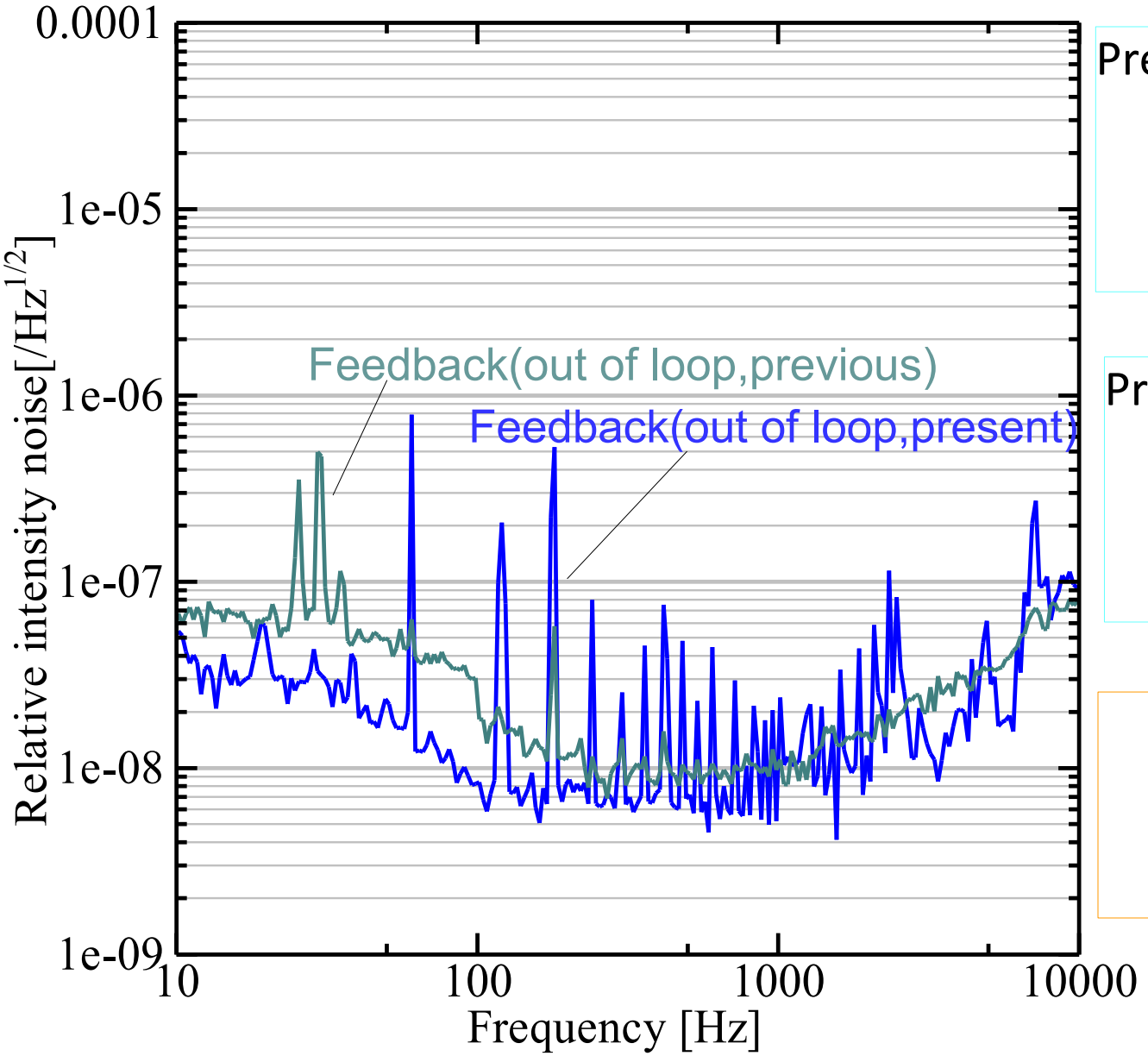
3.1×10^{-8}/√Hz @30Hz

8.4×10^{-9}/√Hz @100Hz

-28dB @30Hz

-32dB @100Hz

3.Result



Previous deta

4.7×10^{-8}/√Hz @30Hz

1.8×10^{-8}/√Hz @100Hz

Present deta

3.1×10^{-8}/√Hz @30Hz

8.4×10^{-9}/√Hz @100Hz

-3.6dB @30Hz

-6.6dB @100Hz

4.Future plan

- use the circuit which I optimized in substitution for SR560
- improve PD to be able to flows more electric currents
- test it in a clean room