Intensity Stabilization System for Laser

2018/05/19

F2F meeting @Osaka City University

University of Toyama

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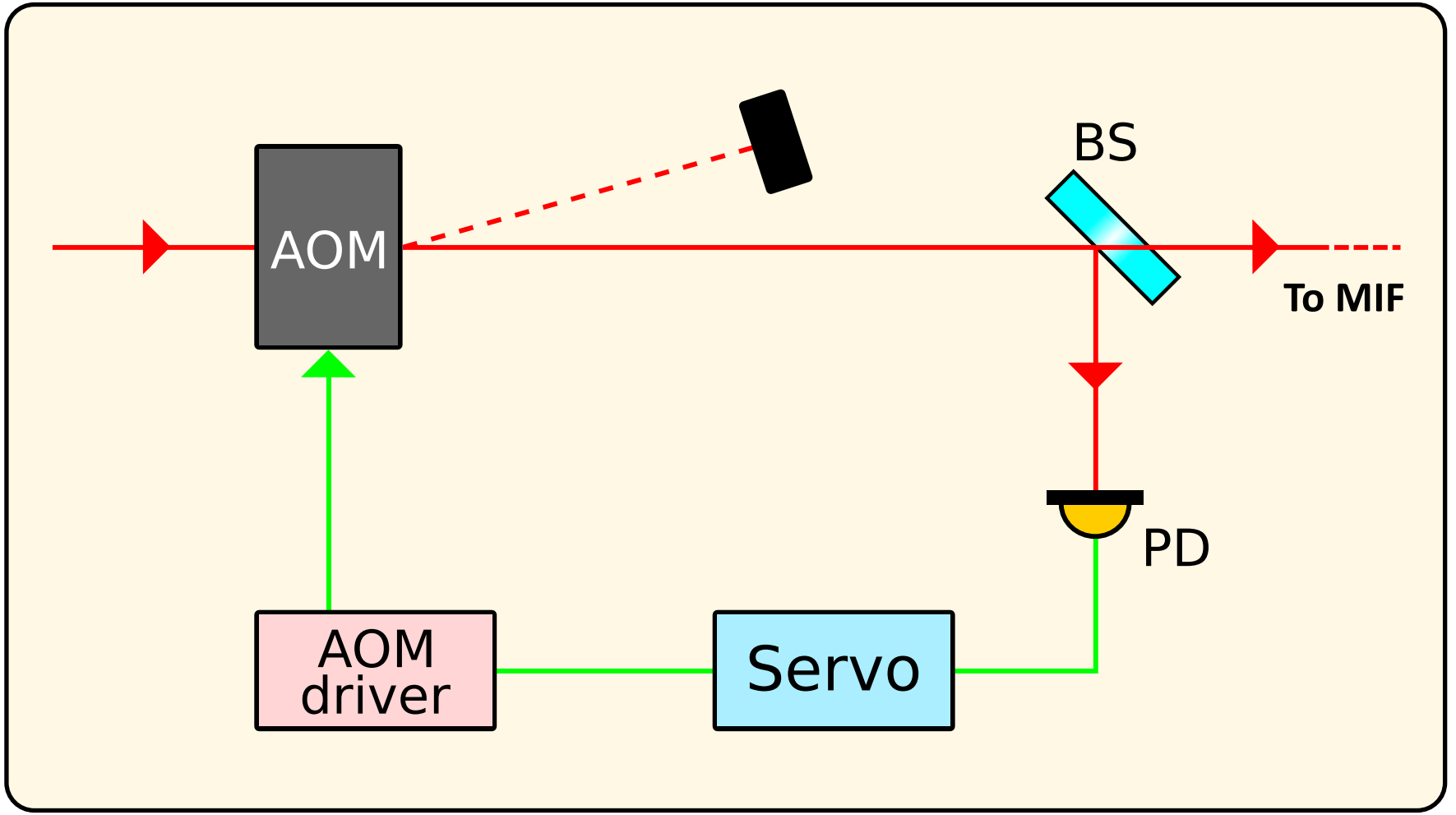
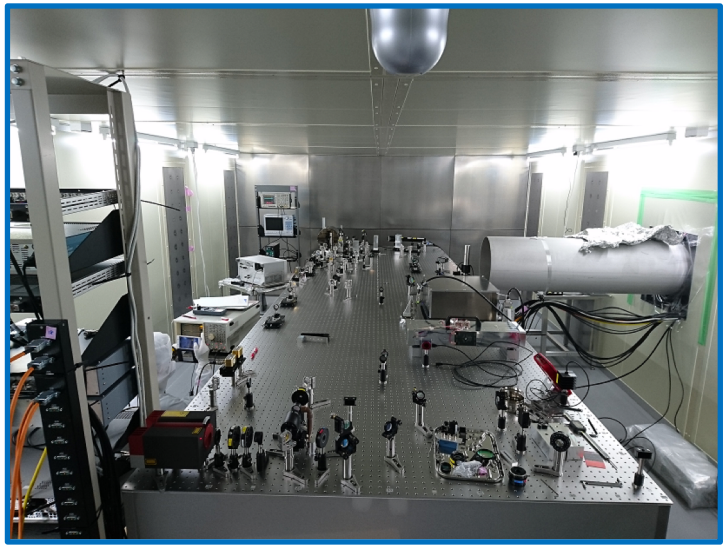
Intensity Stabilization System (ISS)

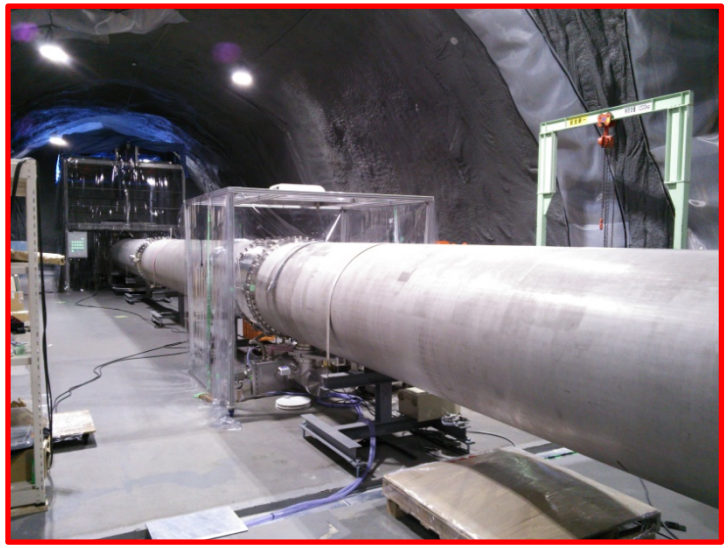


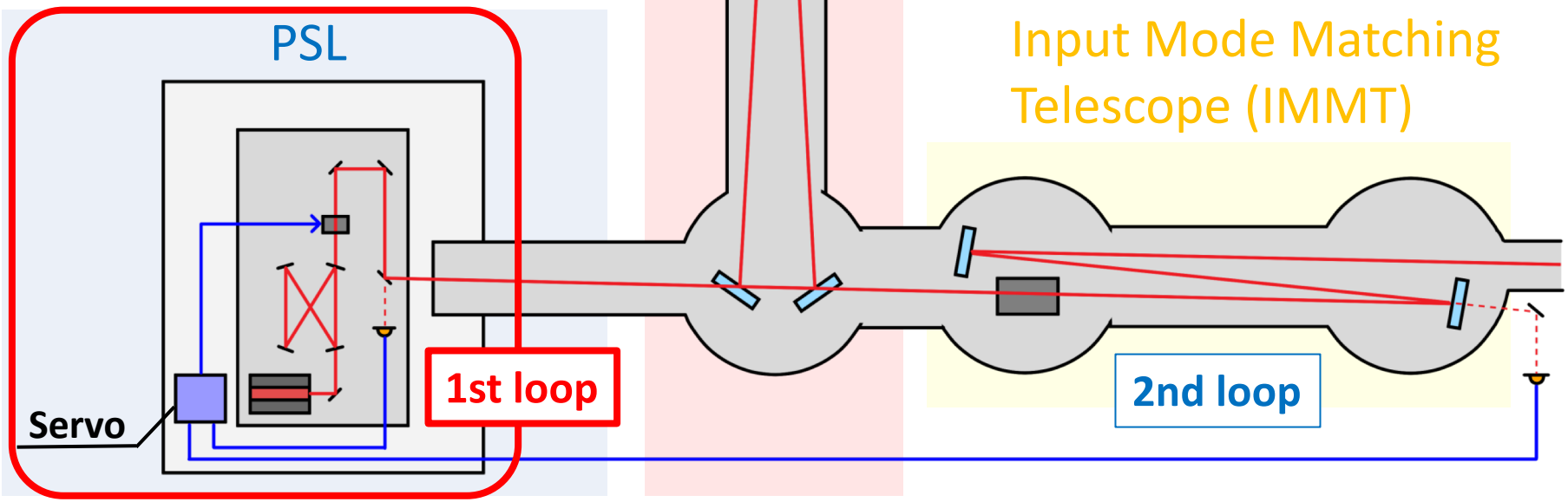
1st and 2nd loop

Pre-Stabilized Laser (PSL)

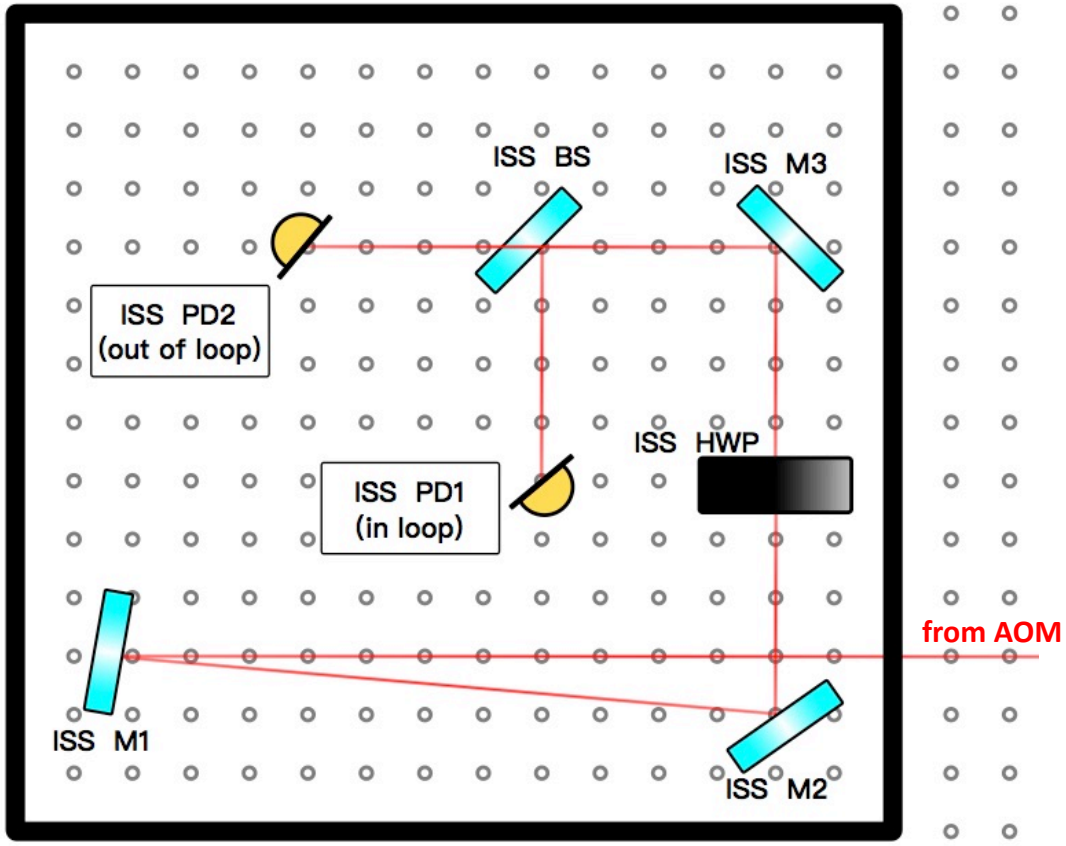


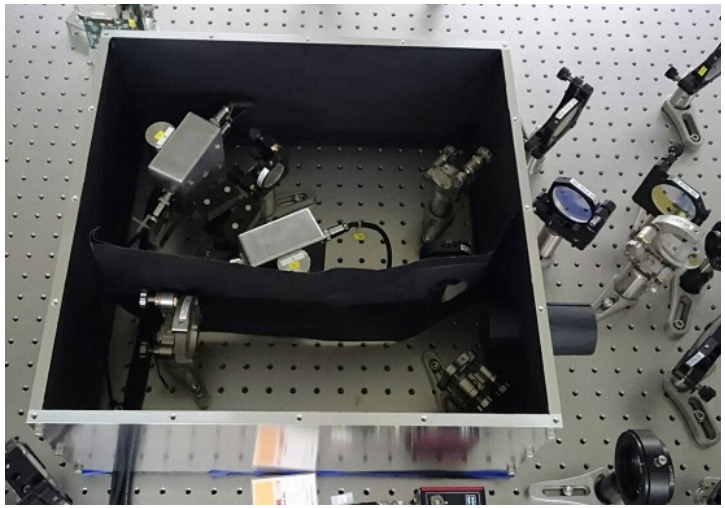
Input Mode Cleaner (IMC)

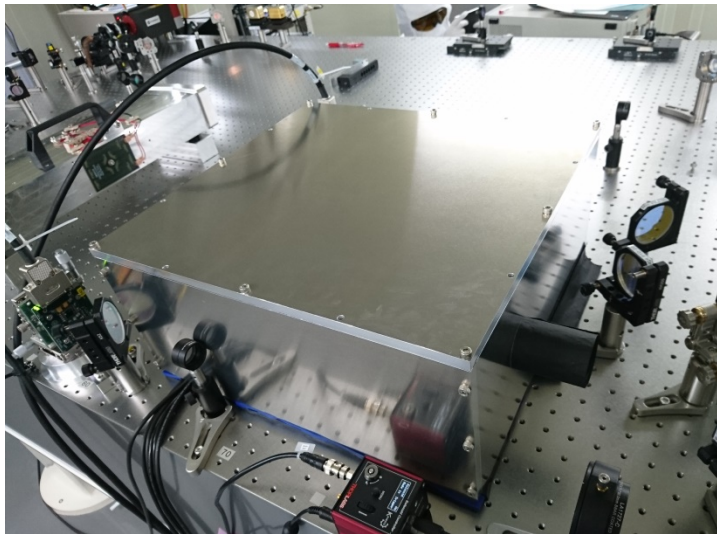




ISS Area (1st - loop)

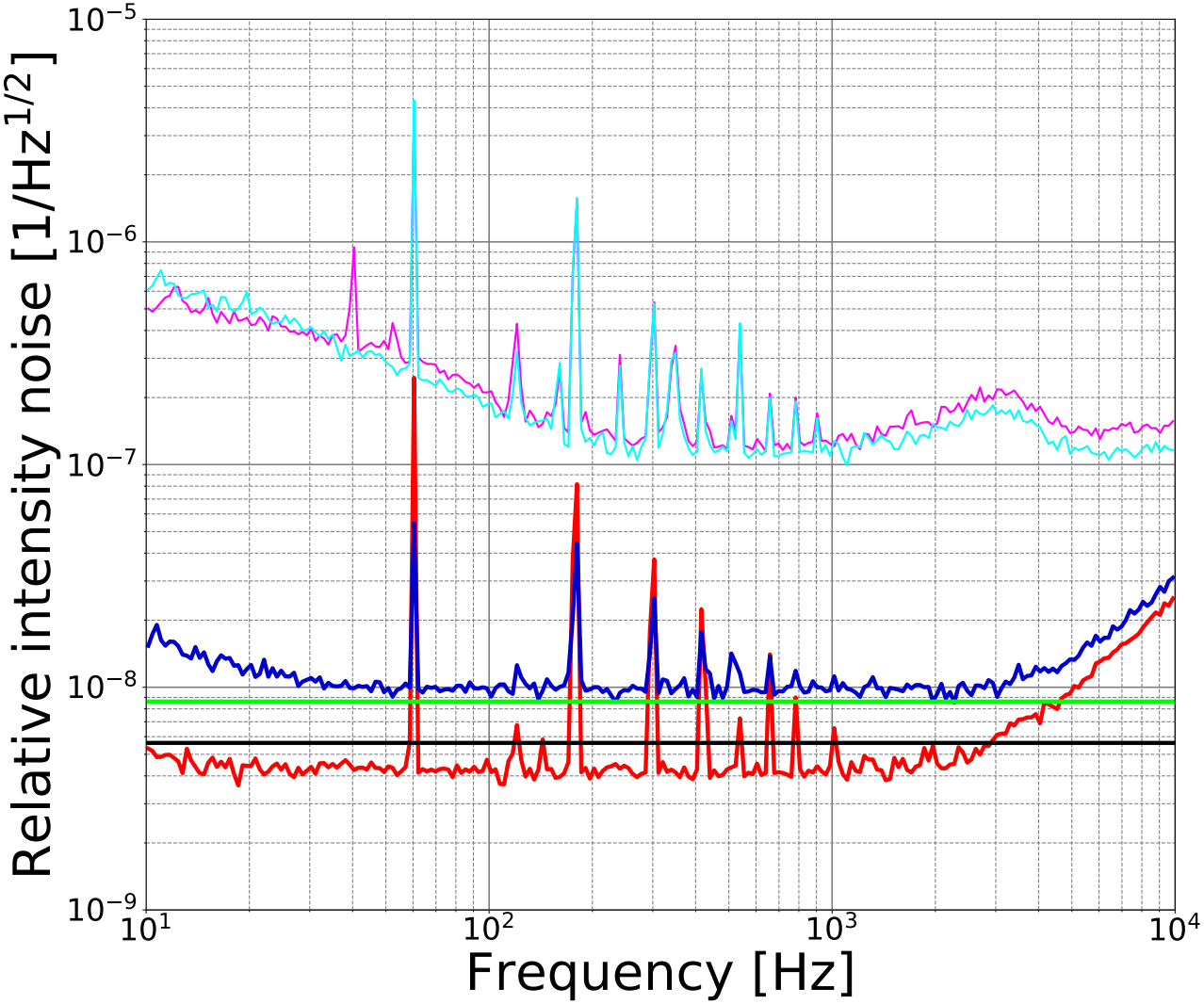






We cover the optics with a box
to block the influence of light and fan.

Result (@U-Toyama)



Input power

In loop	13.0 mW
Out of loop	11.0 mW

Free run (in loop)

Free run (out of loop)

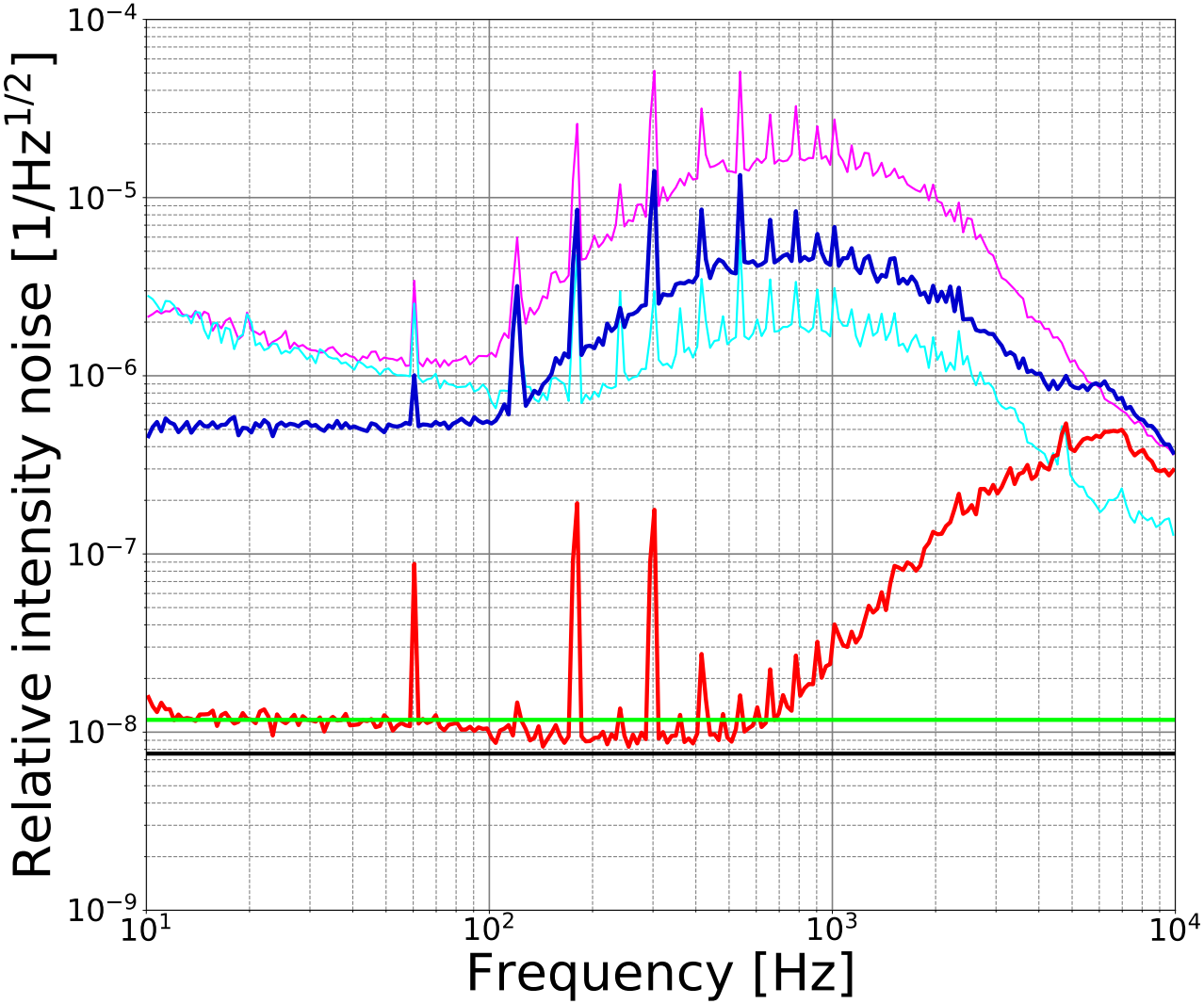
Controlled (in loop)

Controlled (out of loop)

Shot noise (in loop)

Shot noise×$\sqrt{2}$ (out of loop)

Result (@KAGRA)



Input power

In loop	7.1 mW
Out of loop	6.0 mW

Free run (in loop)

Free run (out of loop)

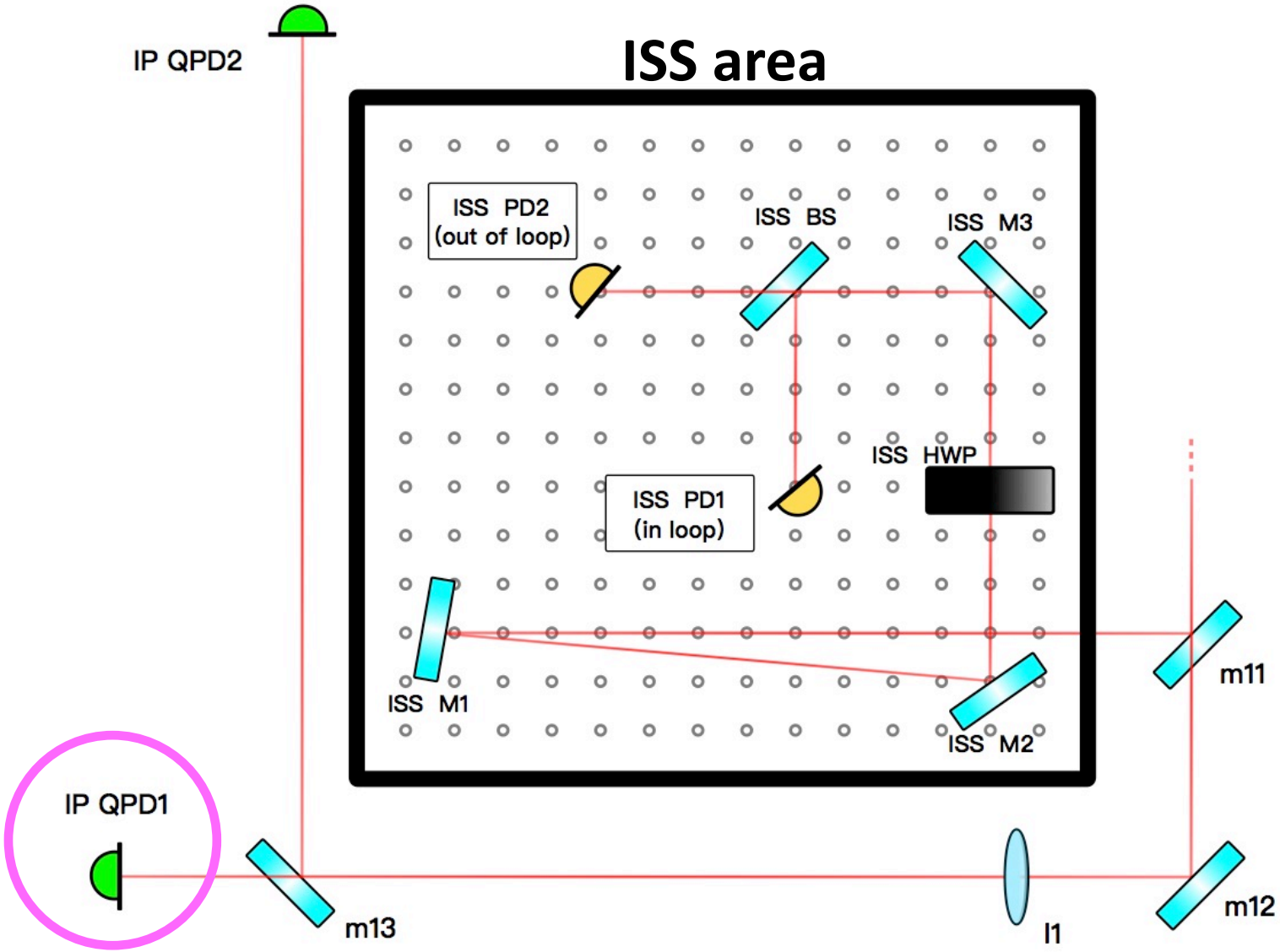
Controlled (in loop)

Controlled (out of loop)

Shot noise (in loop)

Shot noise×$\sqrt{2}$ (out of loop)

Beam jitter measurement



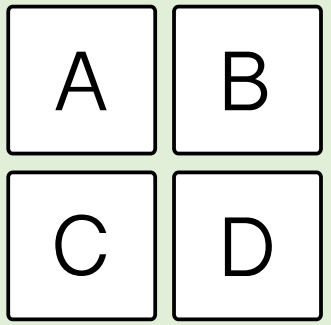
QPD output [V]

We investigate the effect of beam jitter from values of V_H, V_V and FFT of QPD output.

- $V_H = \dfrac{|(V_A + V_C) - (V_B + V_D)|}{V_{tot}}$

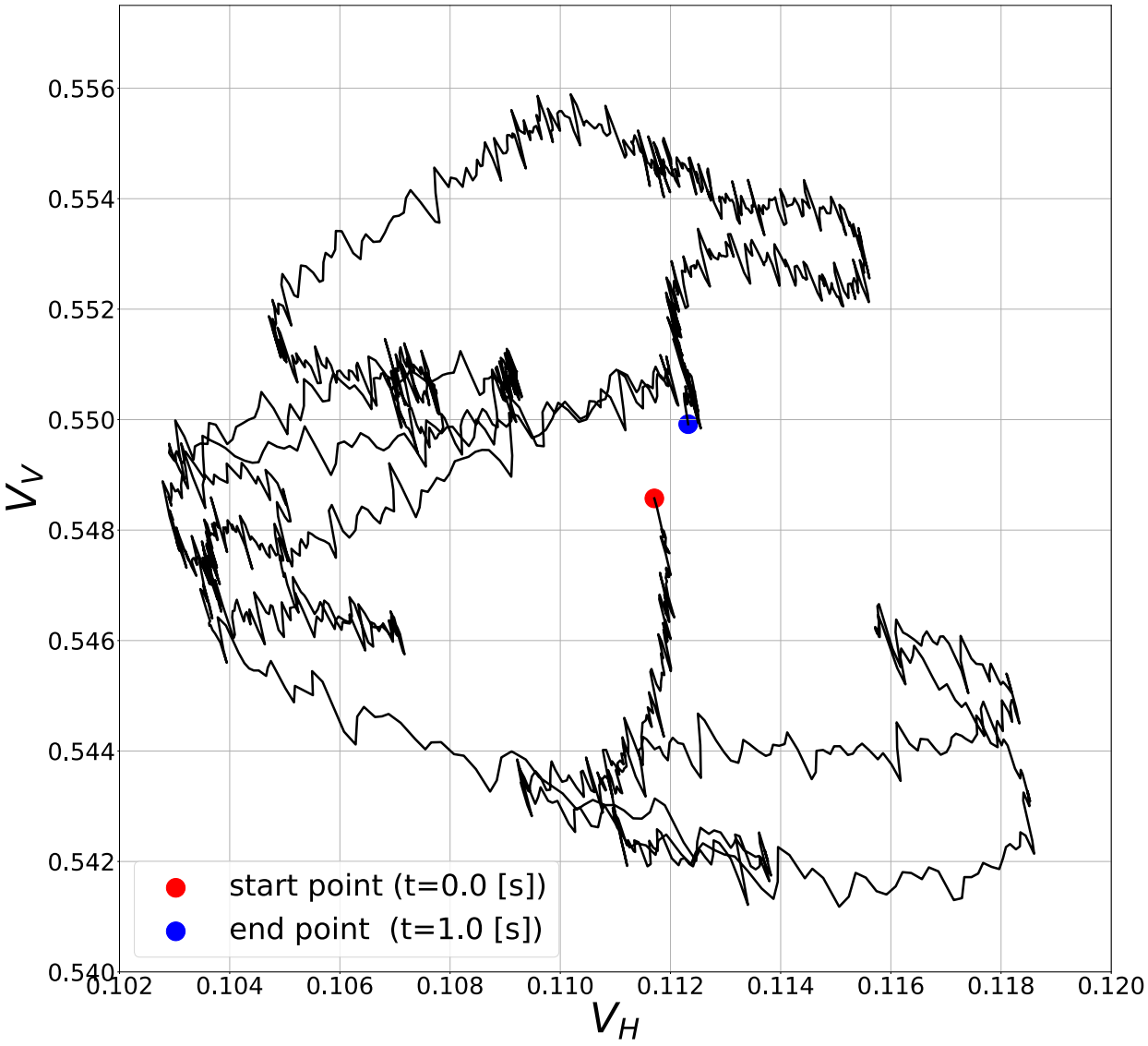
- $V_V = \dfrac{|(V_A + V_B) - (V_C + V_D)|}{V_{tot}}$

$$(V_{tot} = V_A + V_B + V_C + V_D)$$

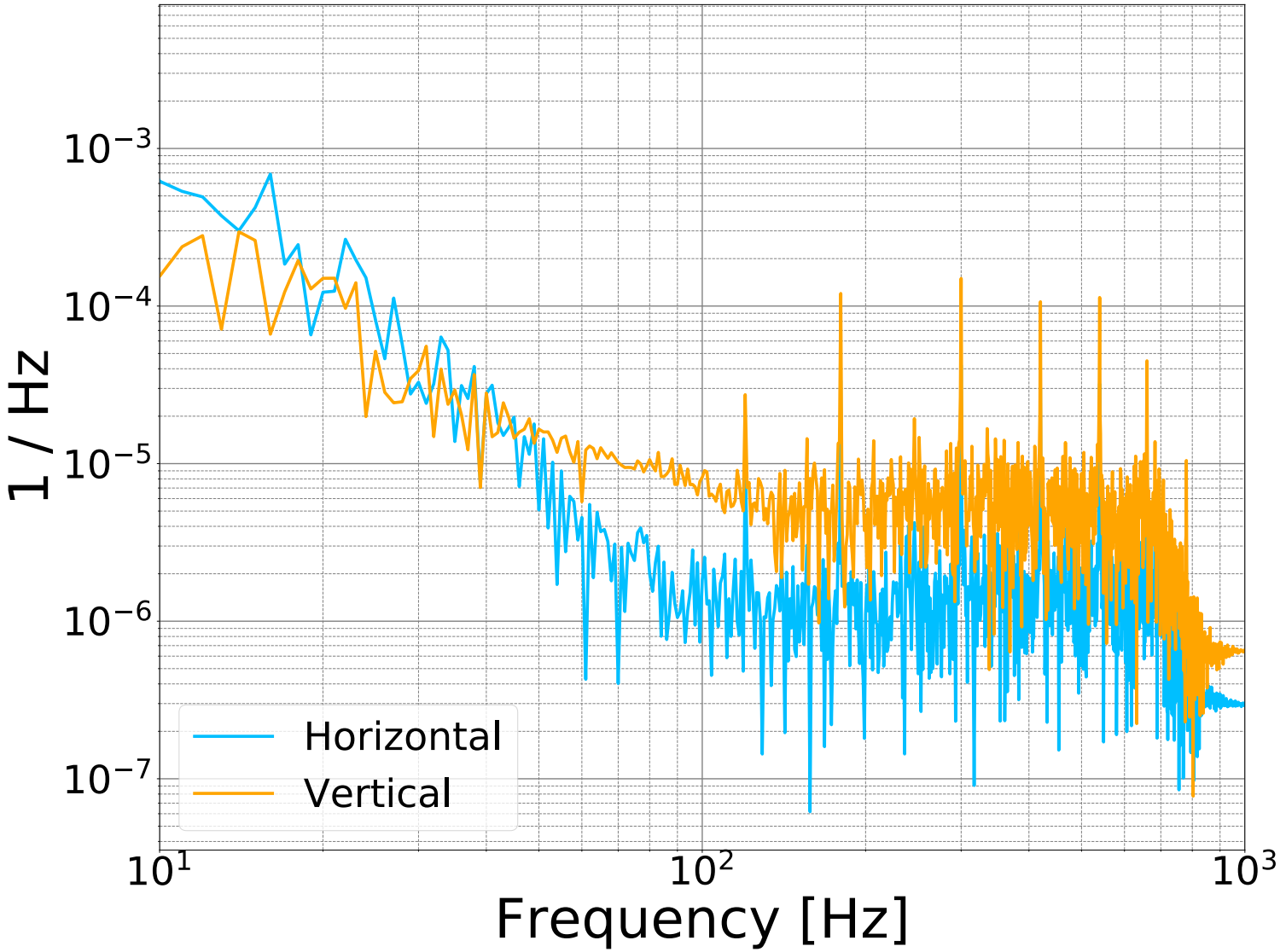


Looking at QPD

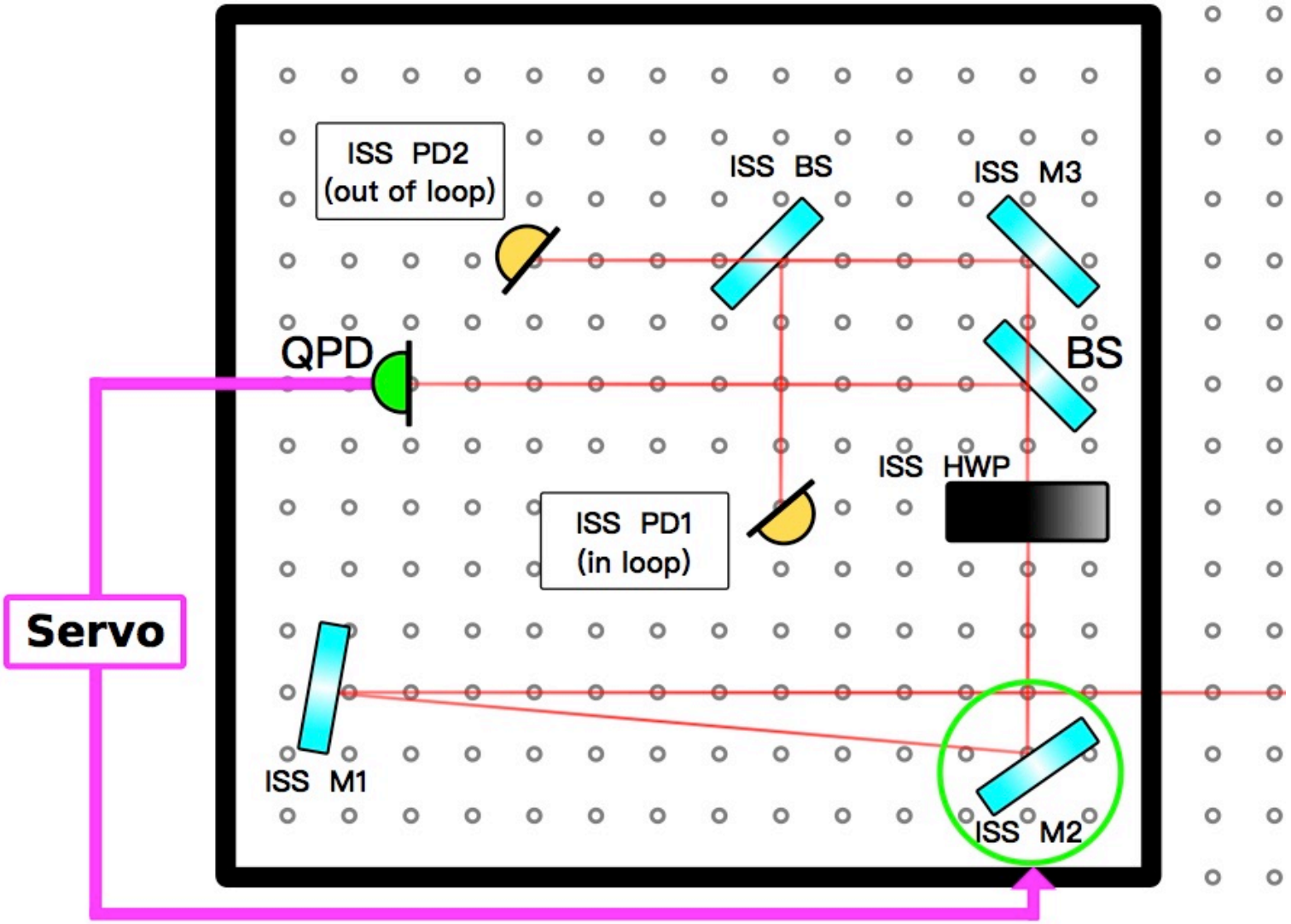
Trace of the laser beam on QPD



FFT of QPD output



How to suppress beam jitter



Summary

- Noise of in loop is comparable to shot noise.
  On the contrary, noise of out of loop is much larger.

- We observe a beam jitter, which could cause noise in out of loop.

Future plan

- We will develop a control system to suppress beam jitter.