

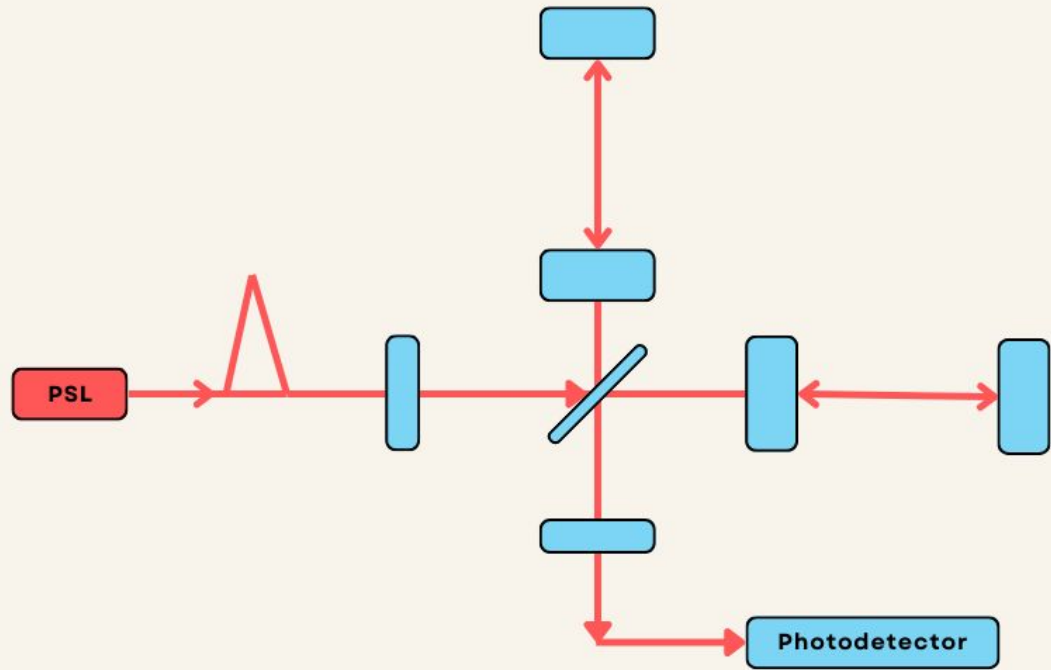
# **Active Monitoring of the Auxiliary Laser Controls**

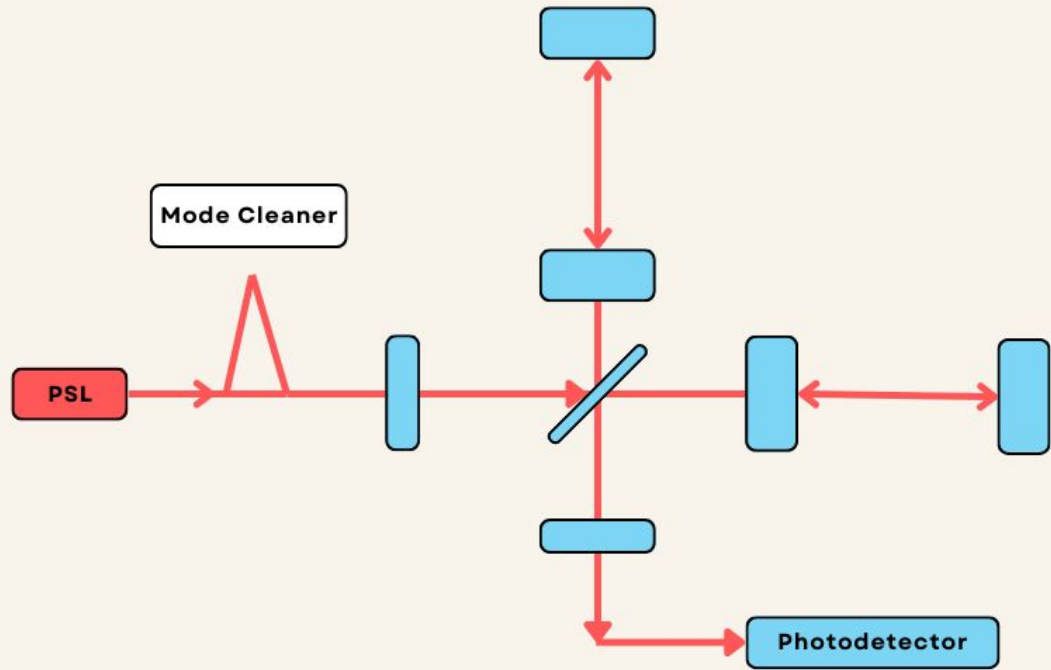
**Cici Hanna**

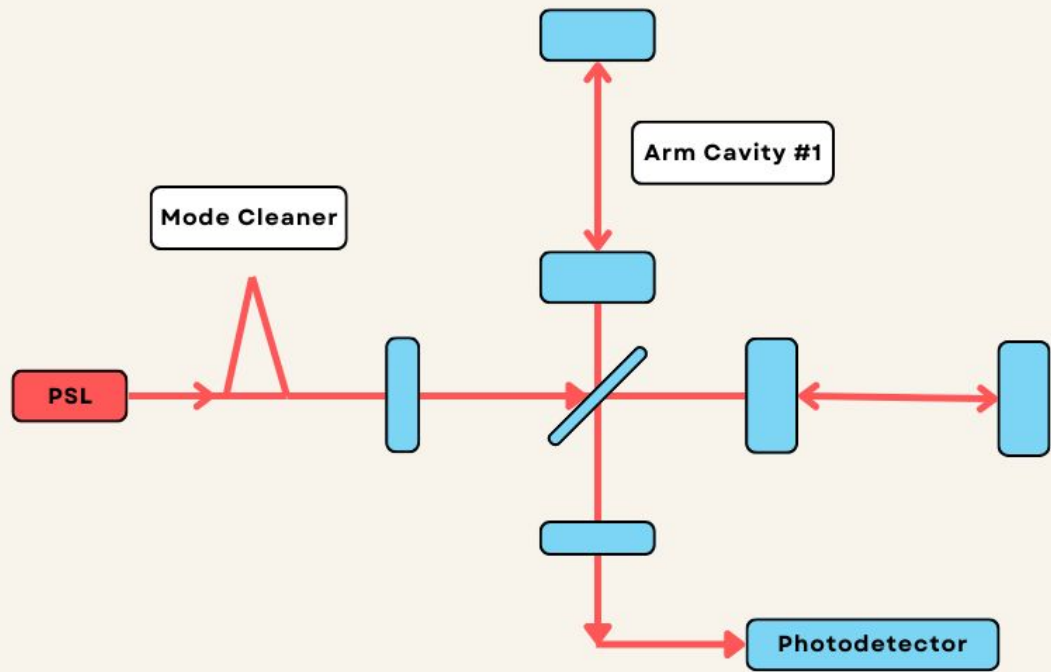
**Francisco Salces-Carcoba, Anchal Gupta, Rana Adhikari**

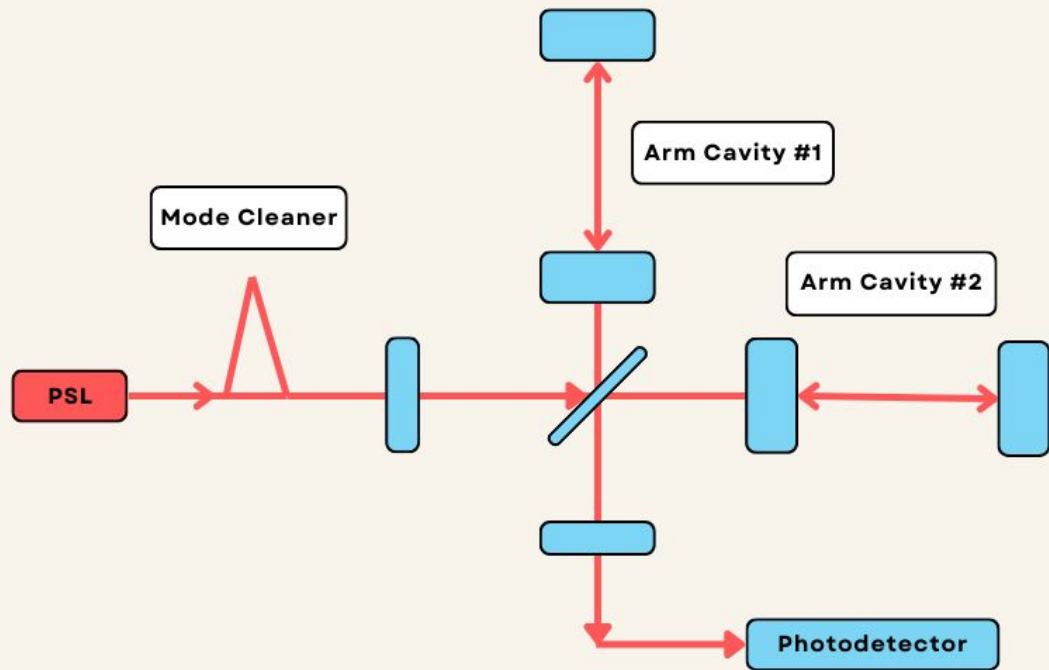
# Question 1:

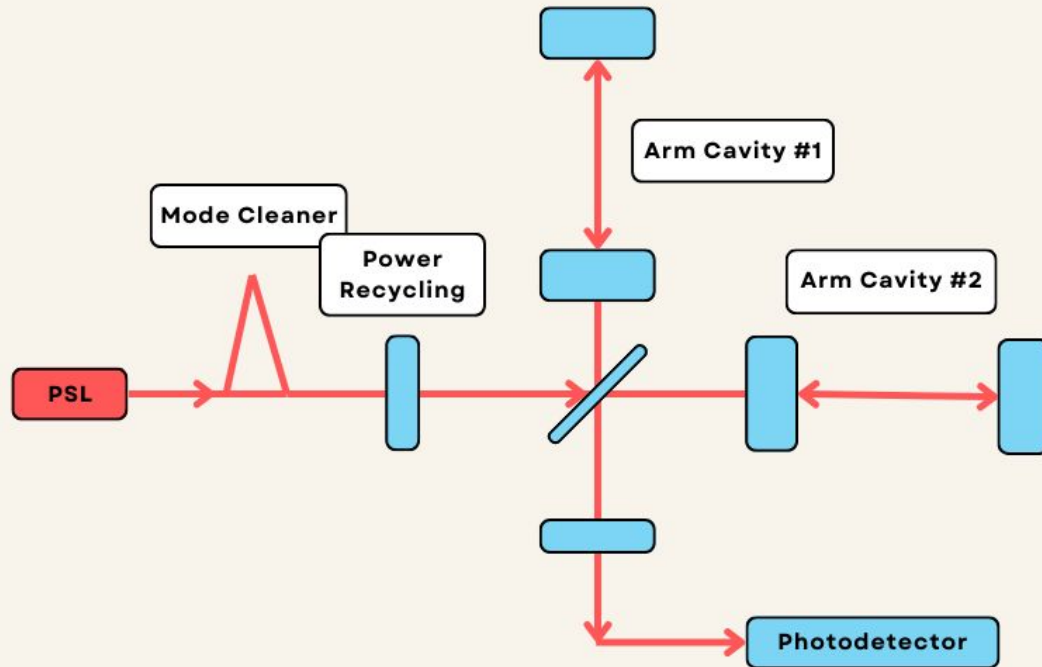
What is the  
Auxiliary Laser?

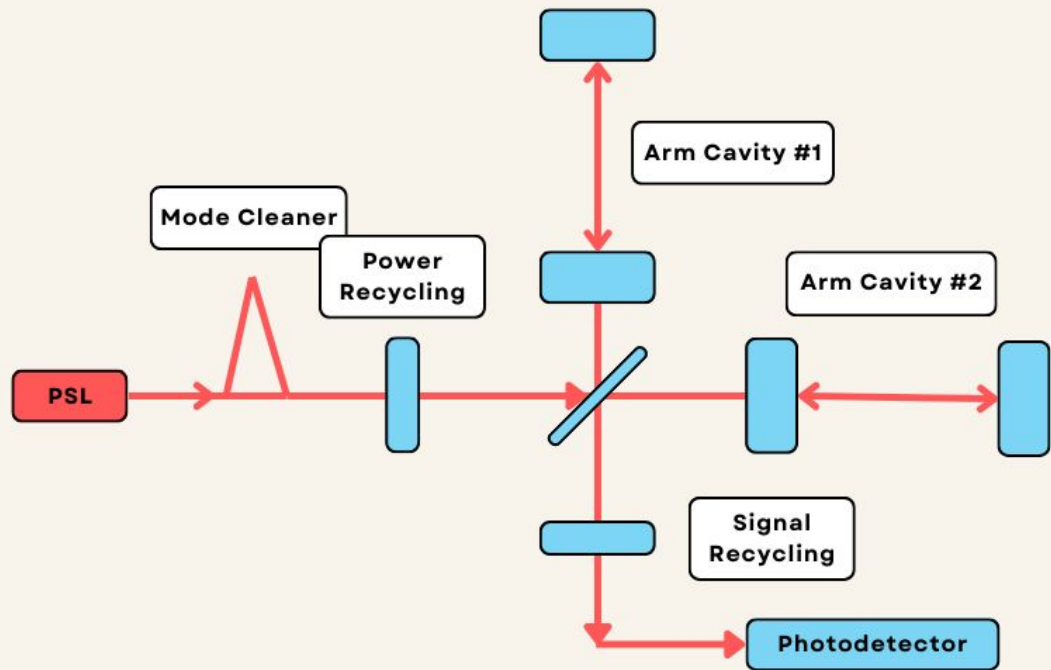




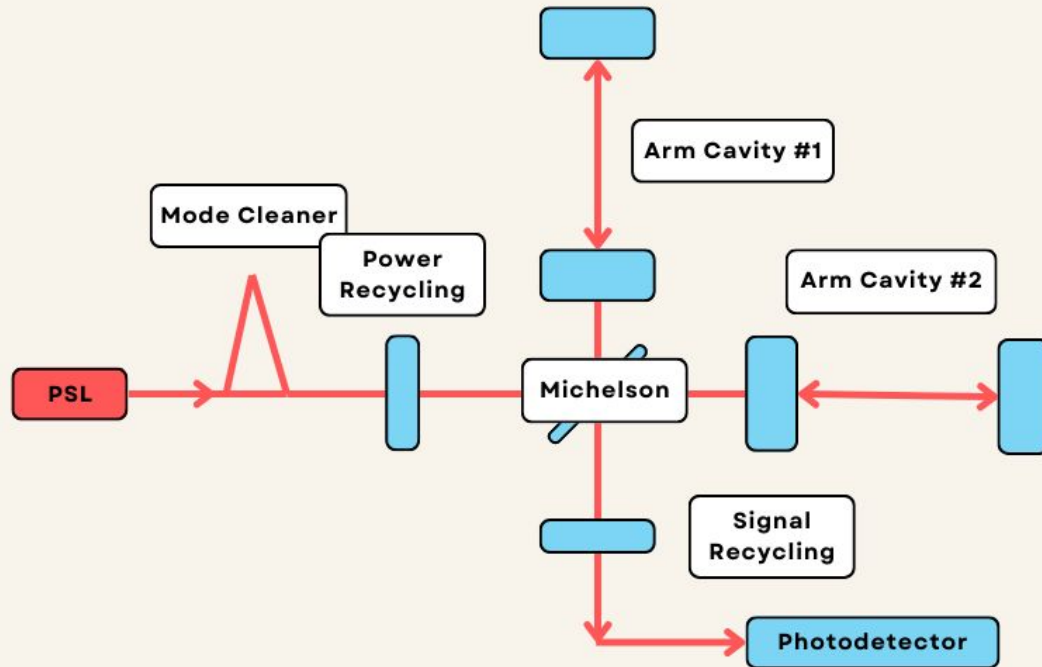


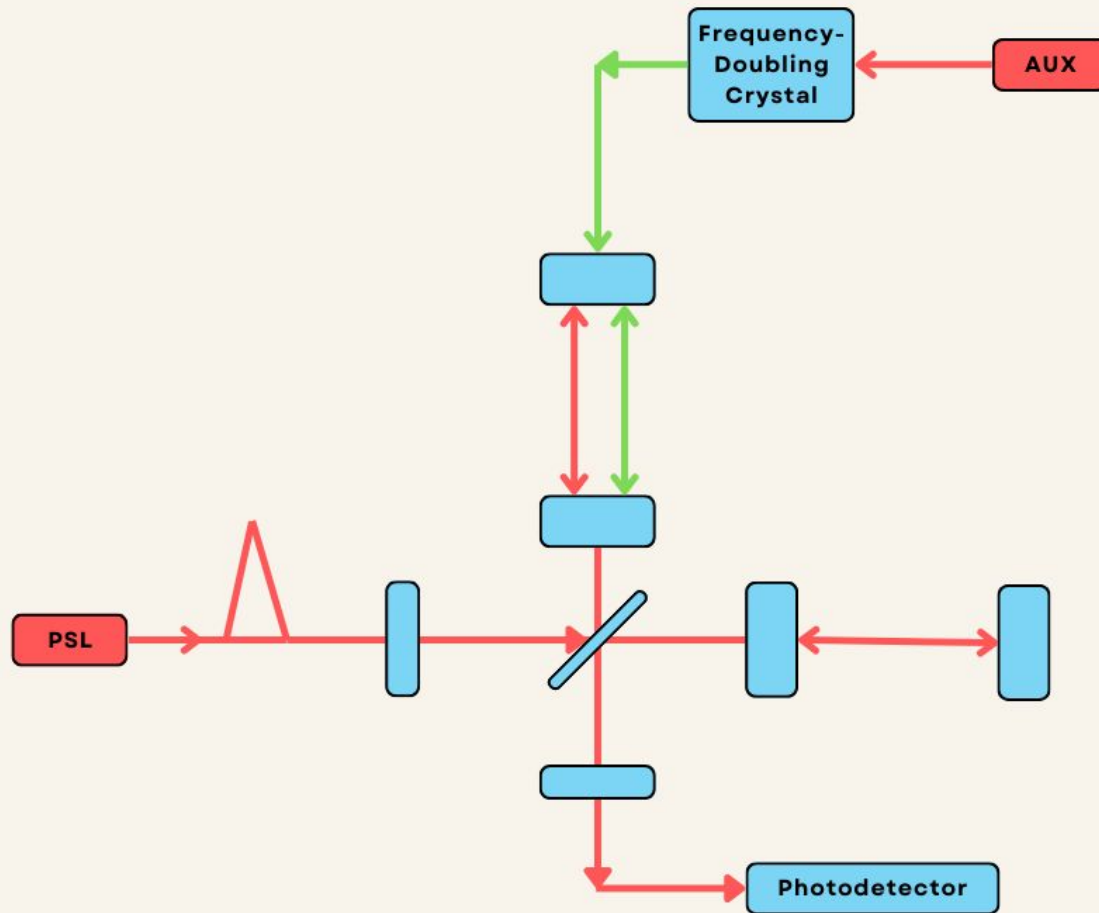


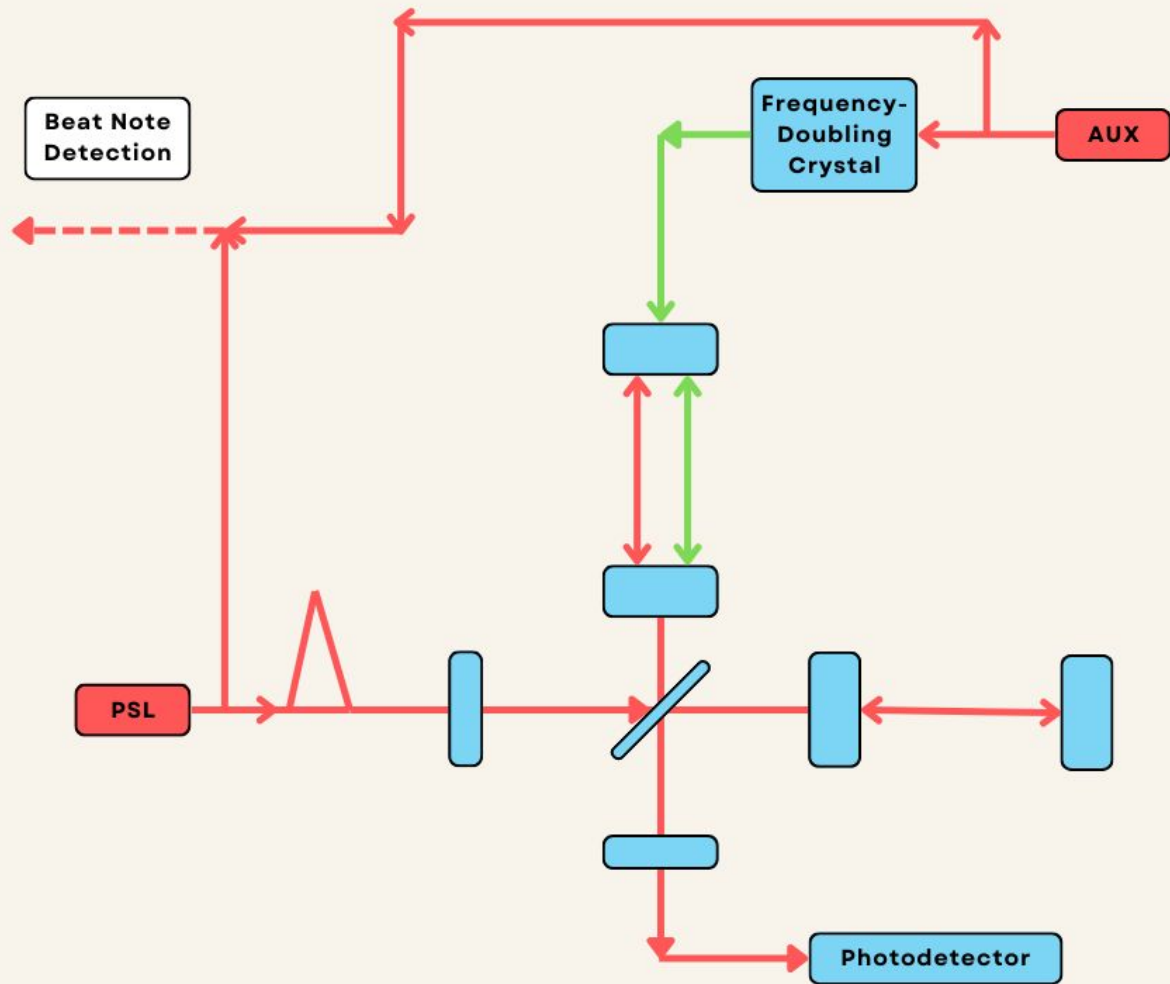




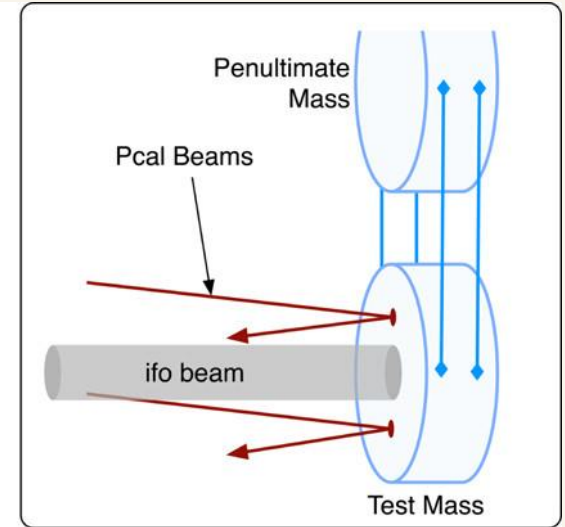
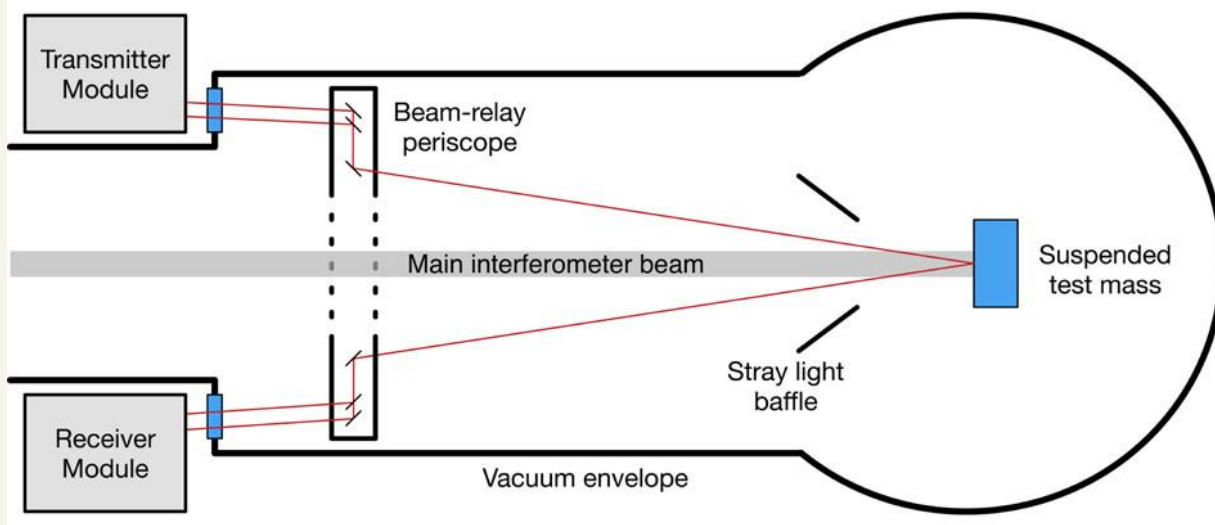






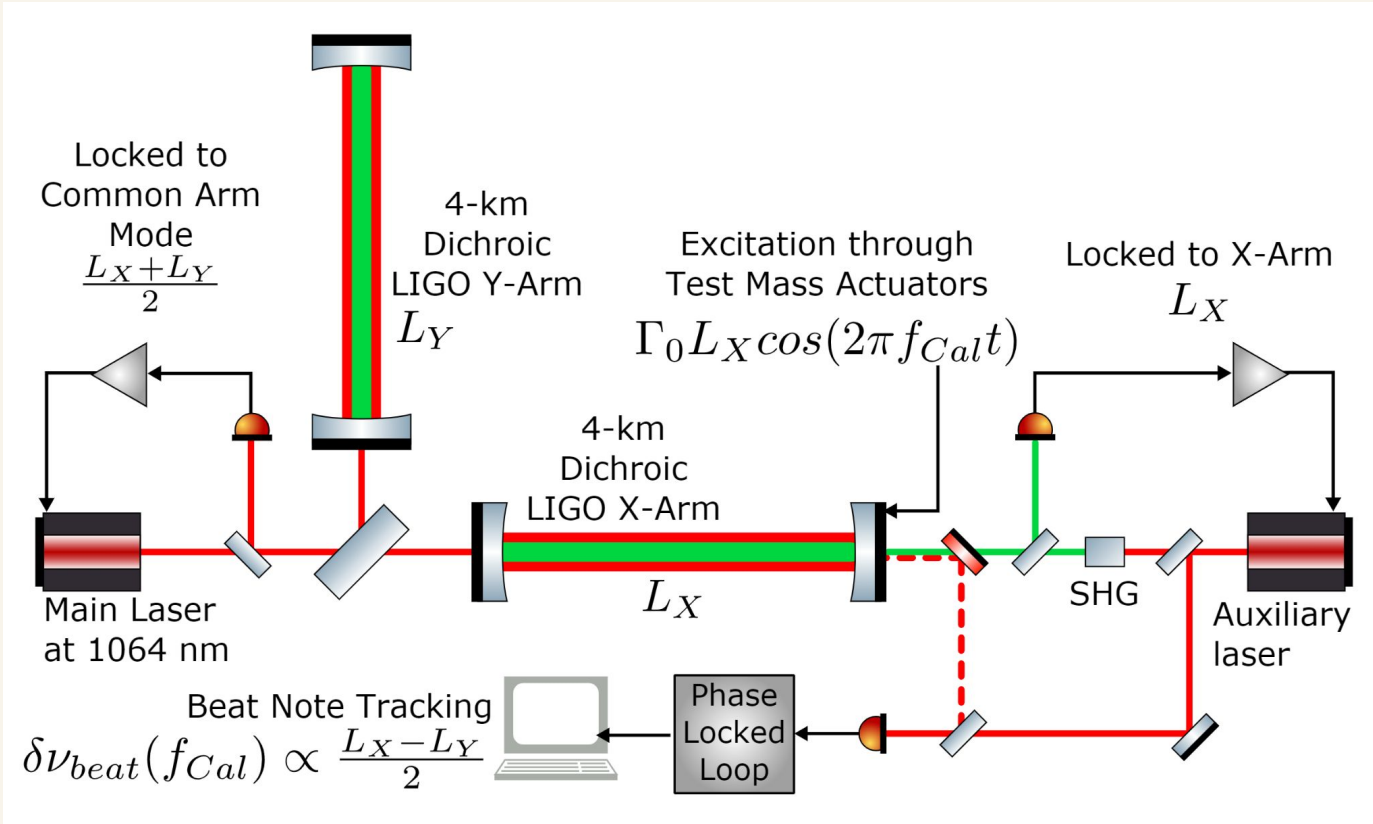


# Current Calibration Scheme



(5)

# Possible Future Calibration Scheme

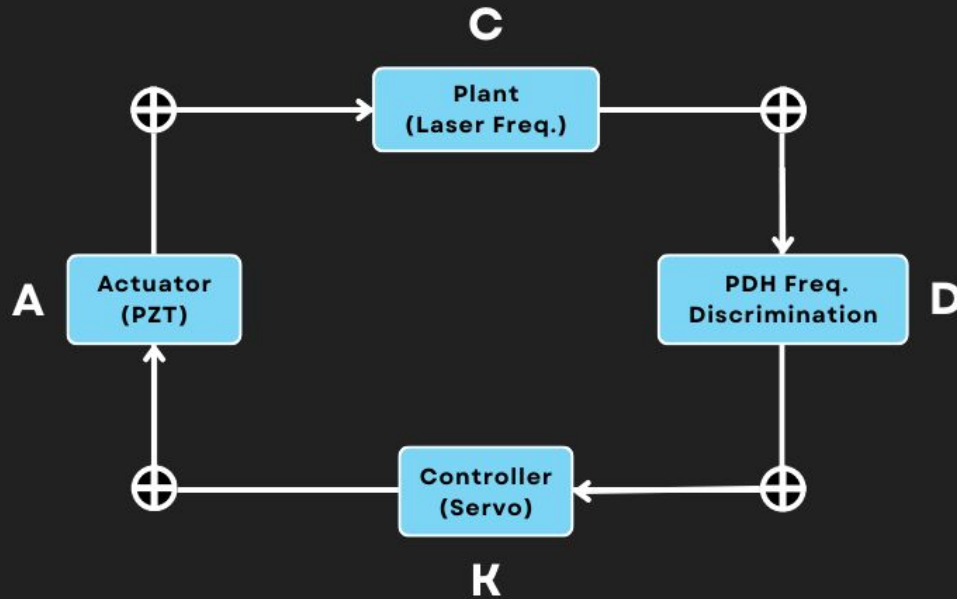


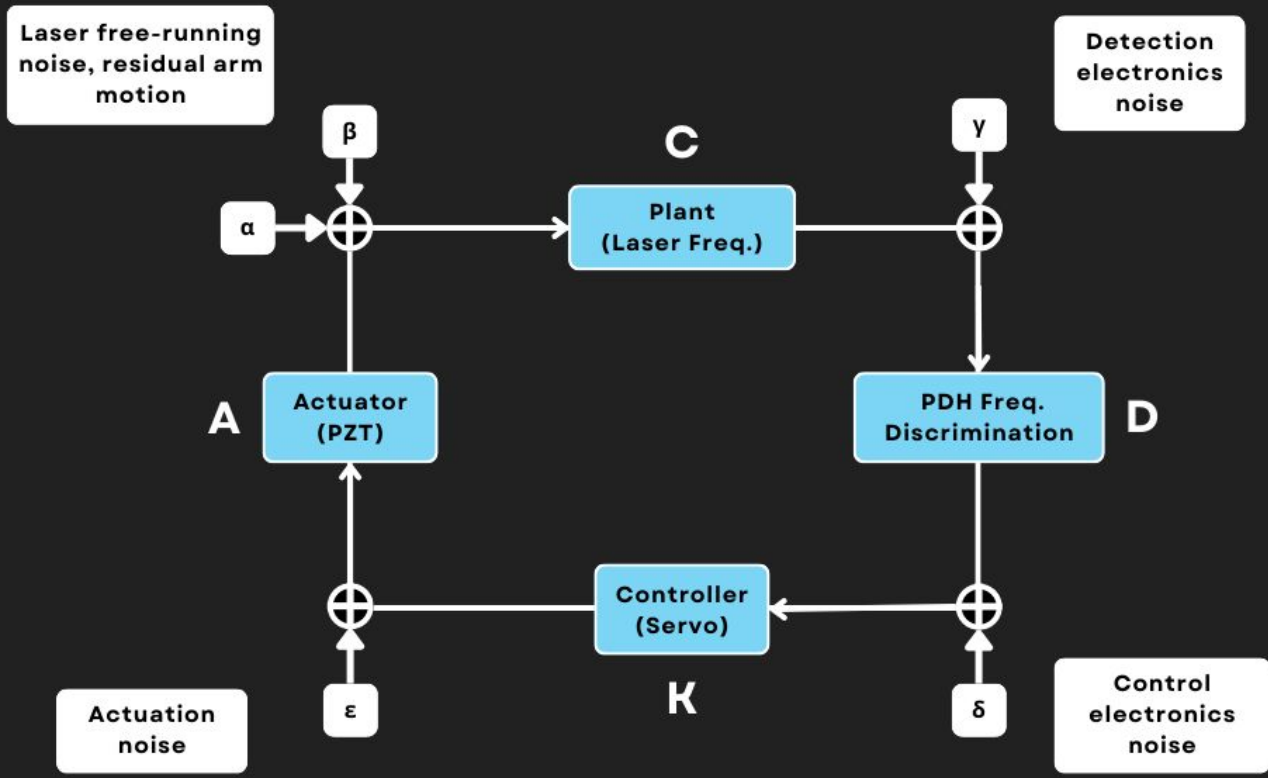
(7)

## **Question 2:**

**What is my  
project?**

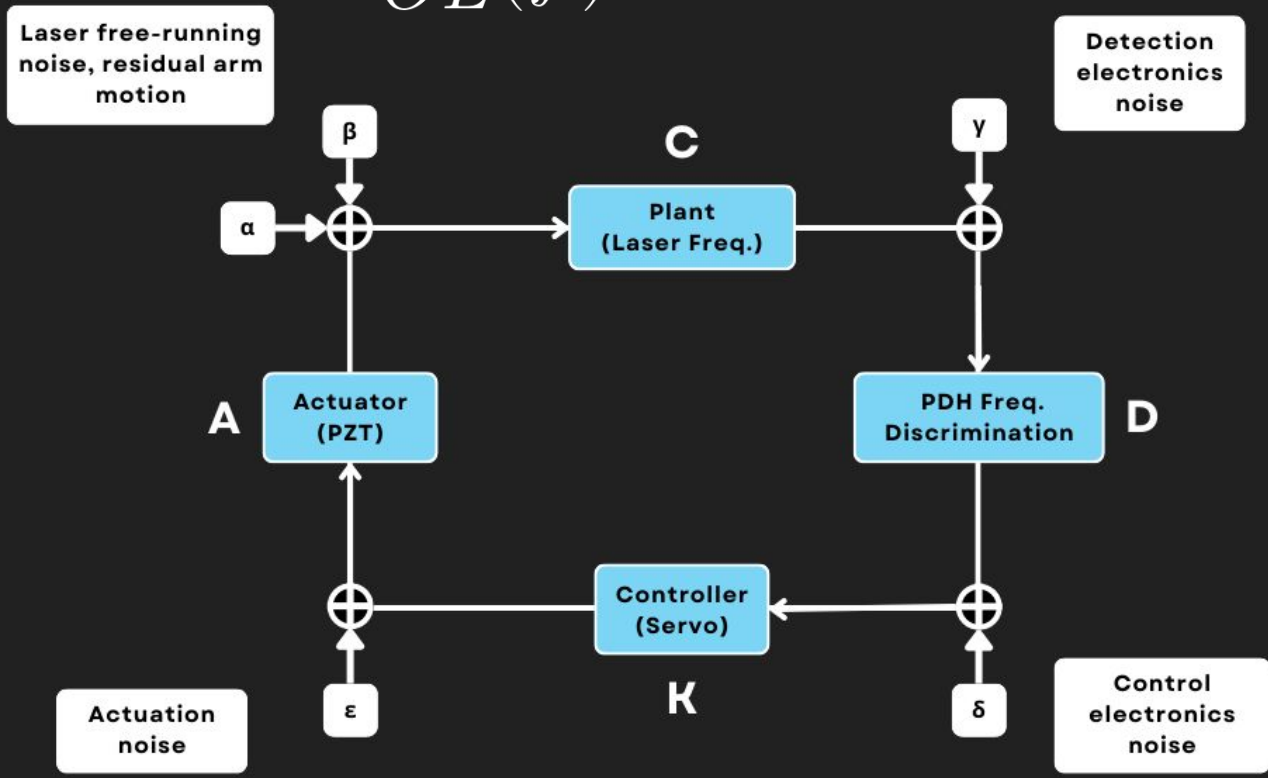
We can characterize the control loop that locks the AUX laser to the cavity length:



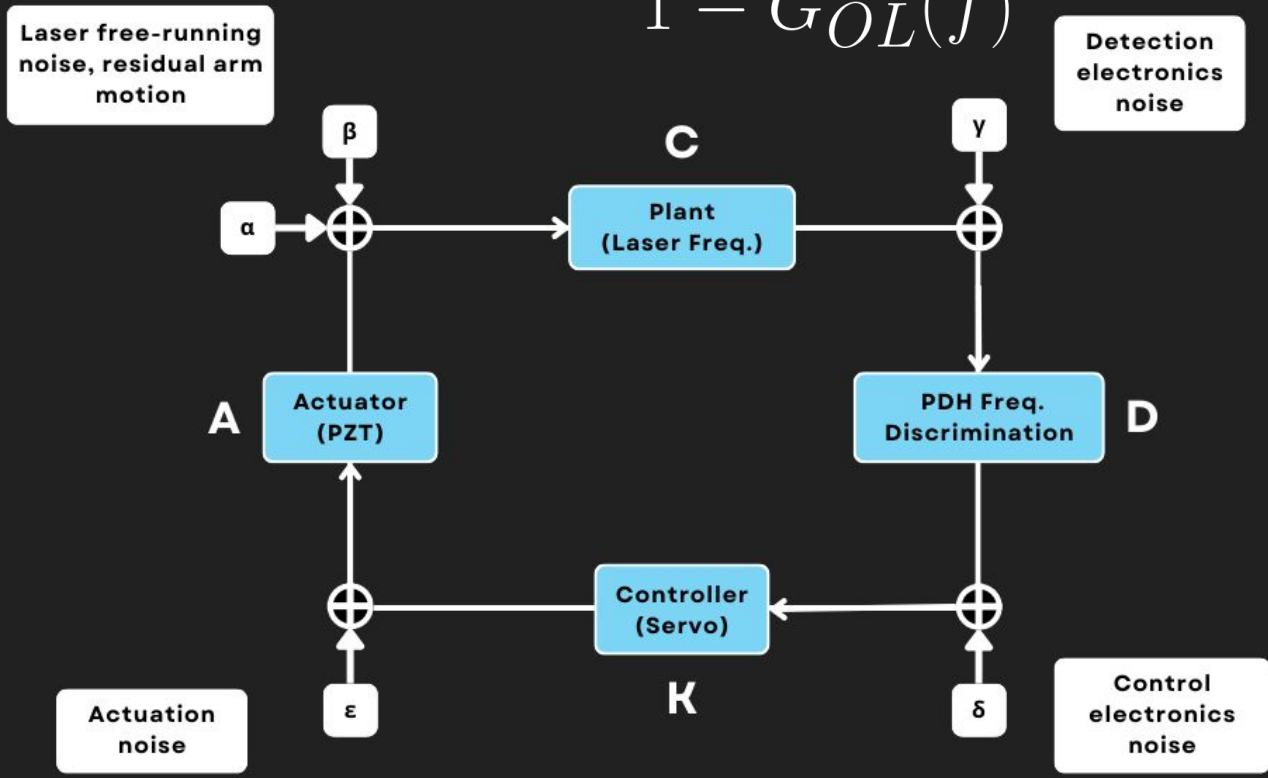


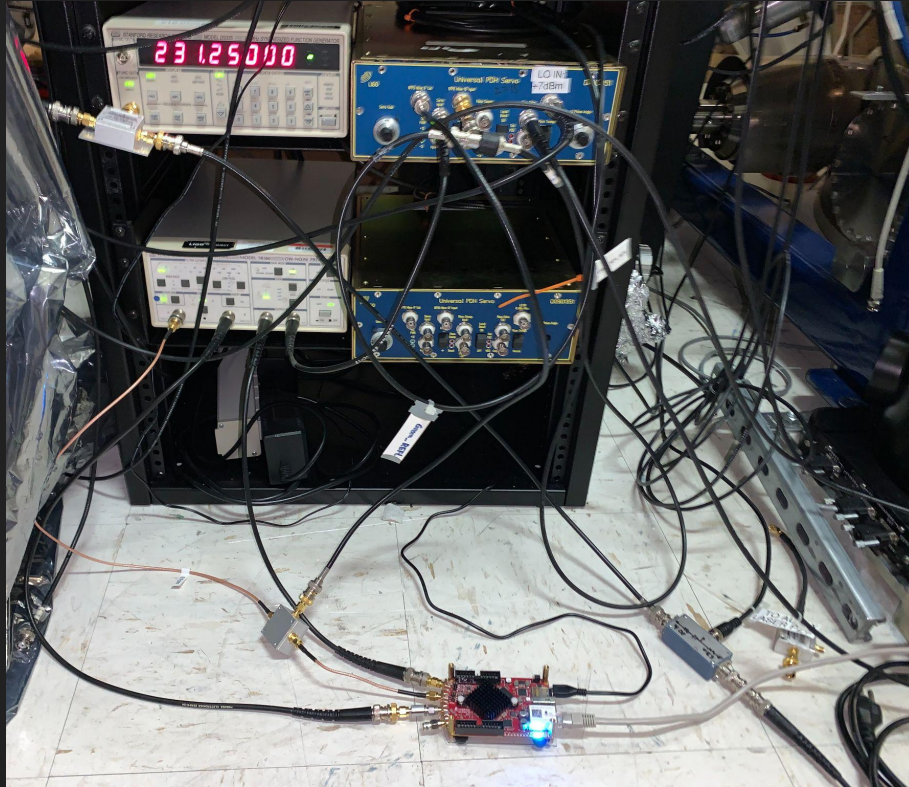


$$G_{OL}(f) = ACDK$$



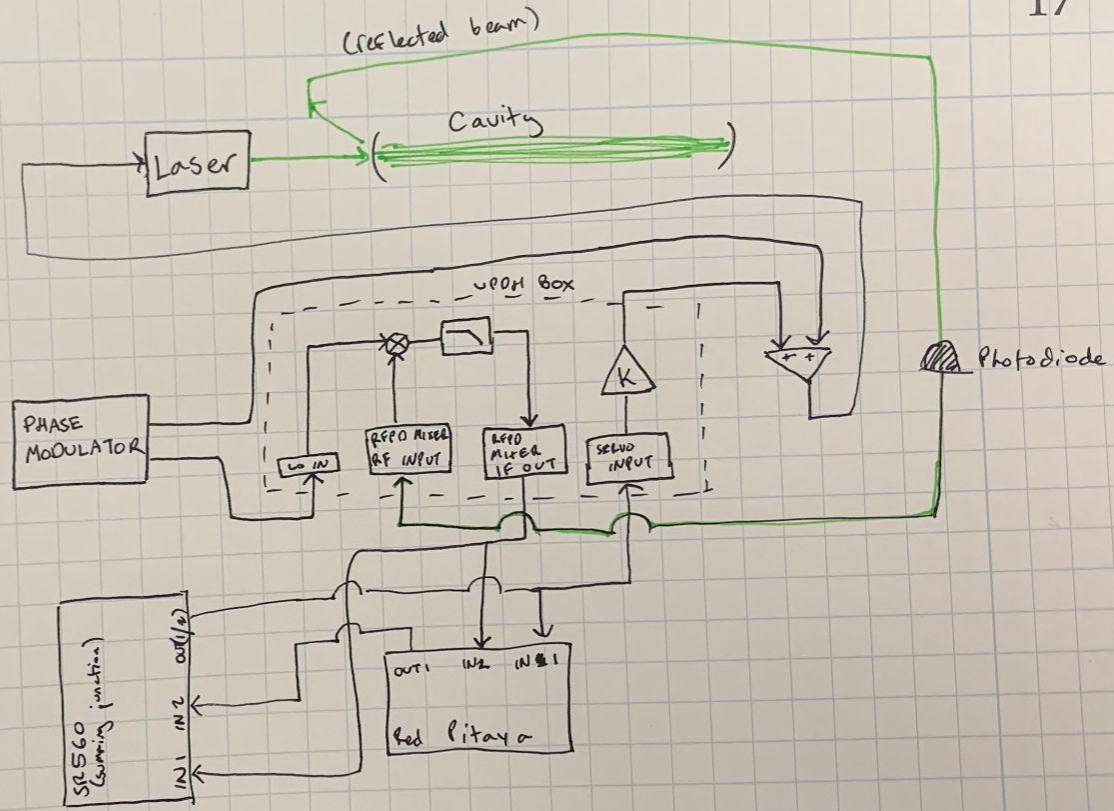
$$G_{CL}(f) = \frac{1}{1 - G_{OL}(f)}$$



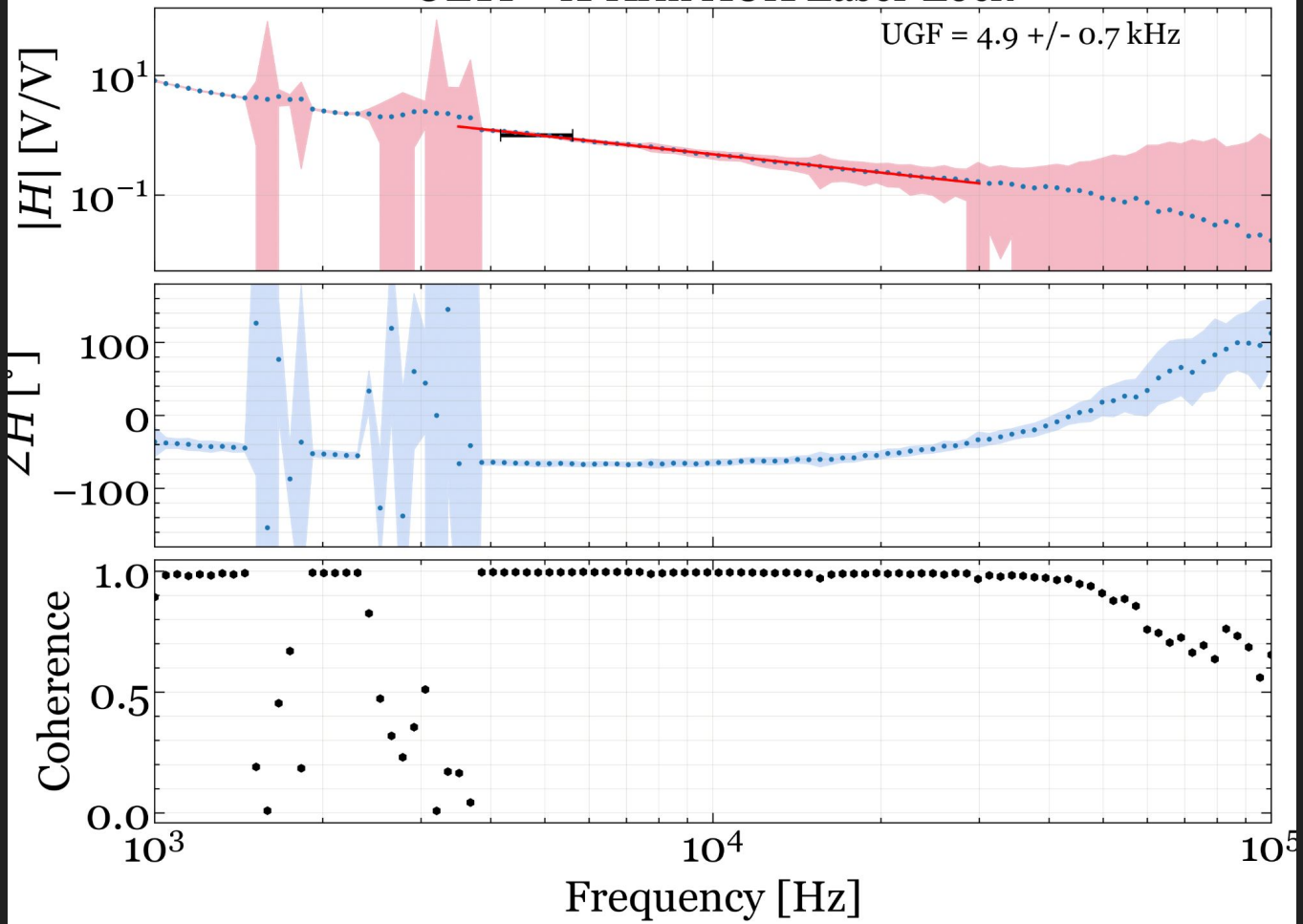


## Red Pitaya STEMLab 125-10

- Signal Generator
- Spectrum Analyzer
- Vector Network Analyzer



# OLTF - X-Arm AUX Laser Lock



# Uncertainty

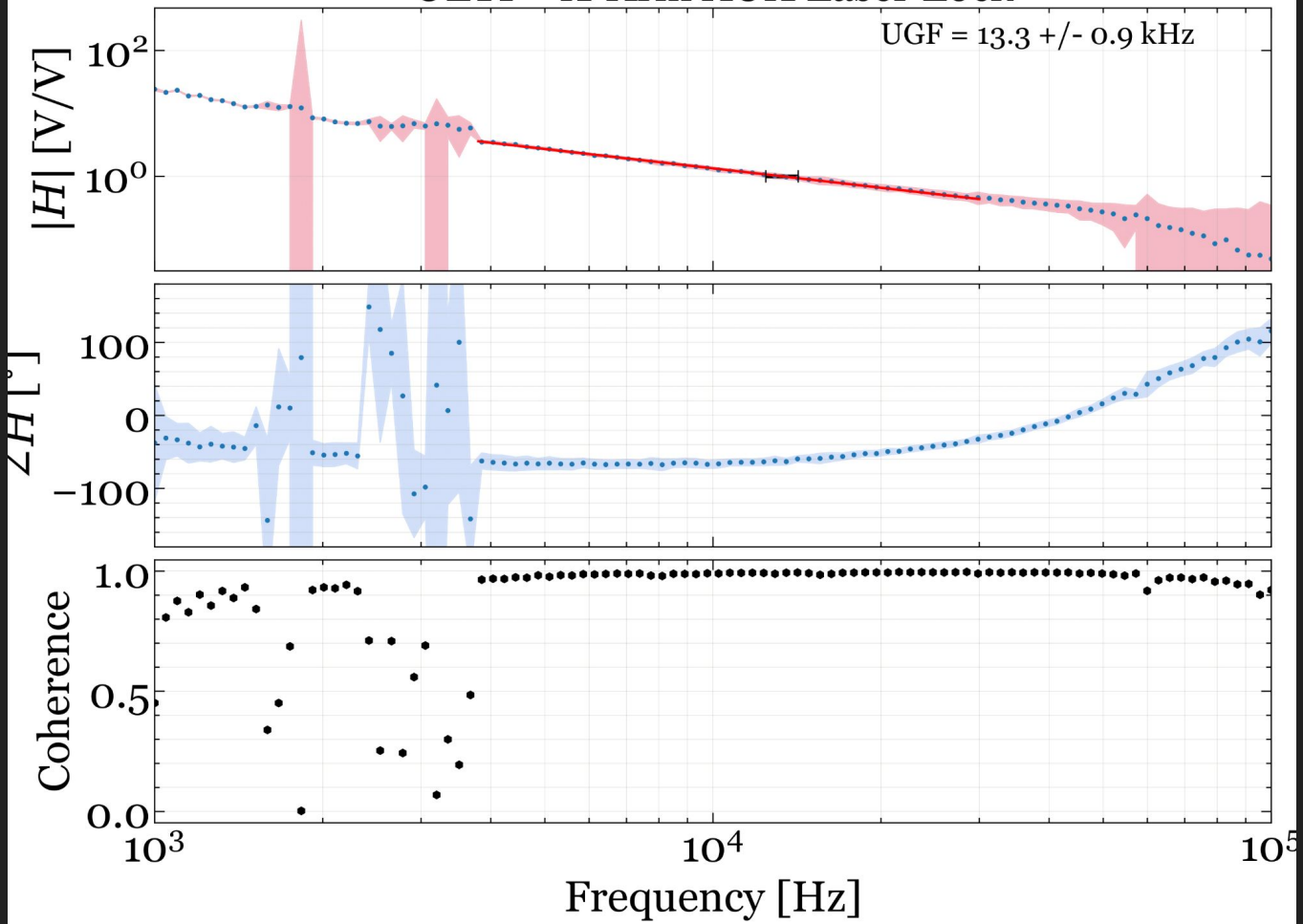
- Least-squares fit, weighted by coherence

$$\Delta |H| = \frac{[1 - \gamma^2(f)]^{\frac{1}{2}}}{|\gamma(f)| \sqrt{2n}} \quad (4)$$

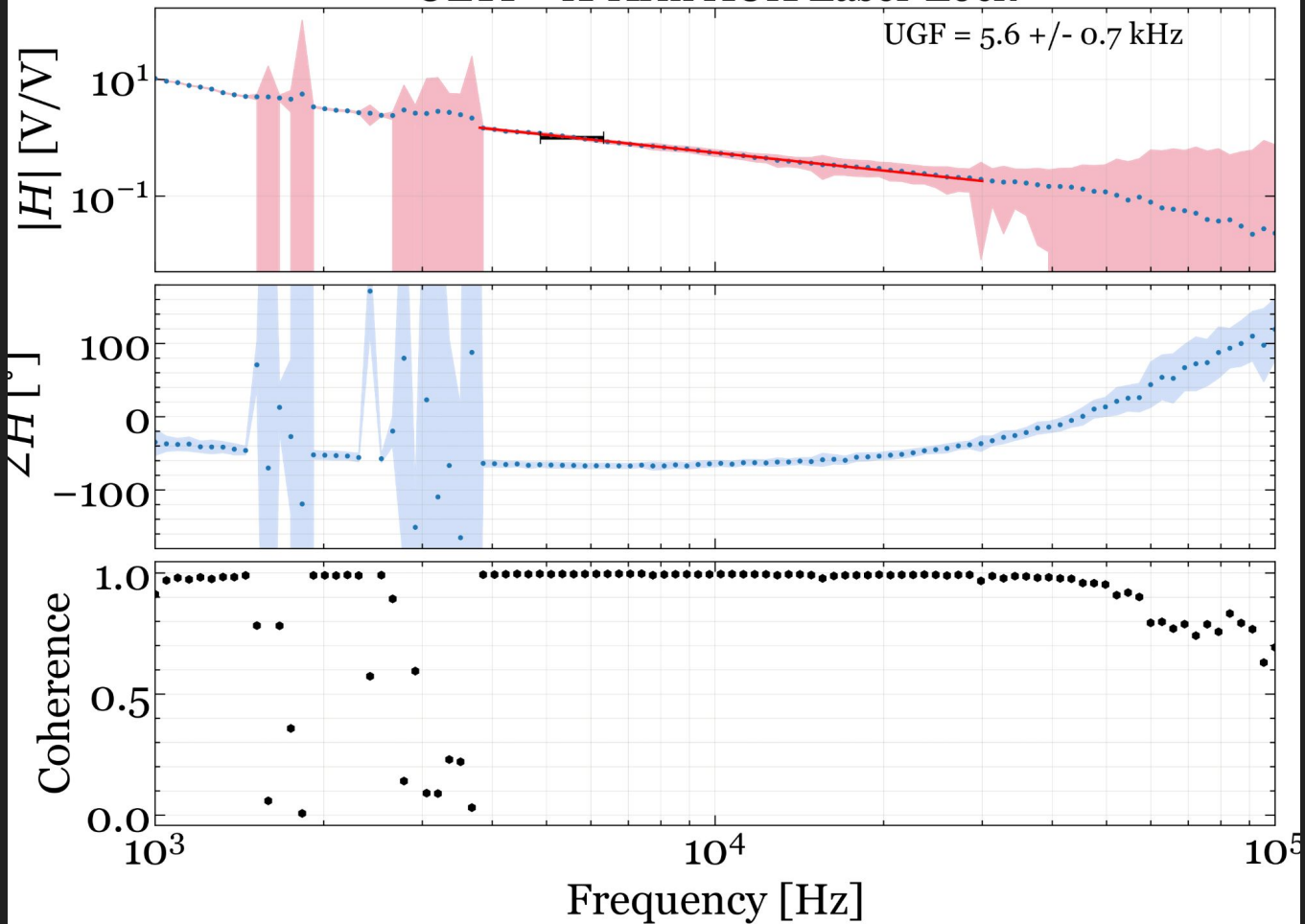
$\gamma$  = coherence

$n$  = number of averages

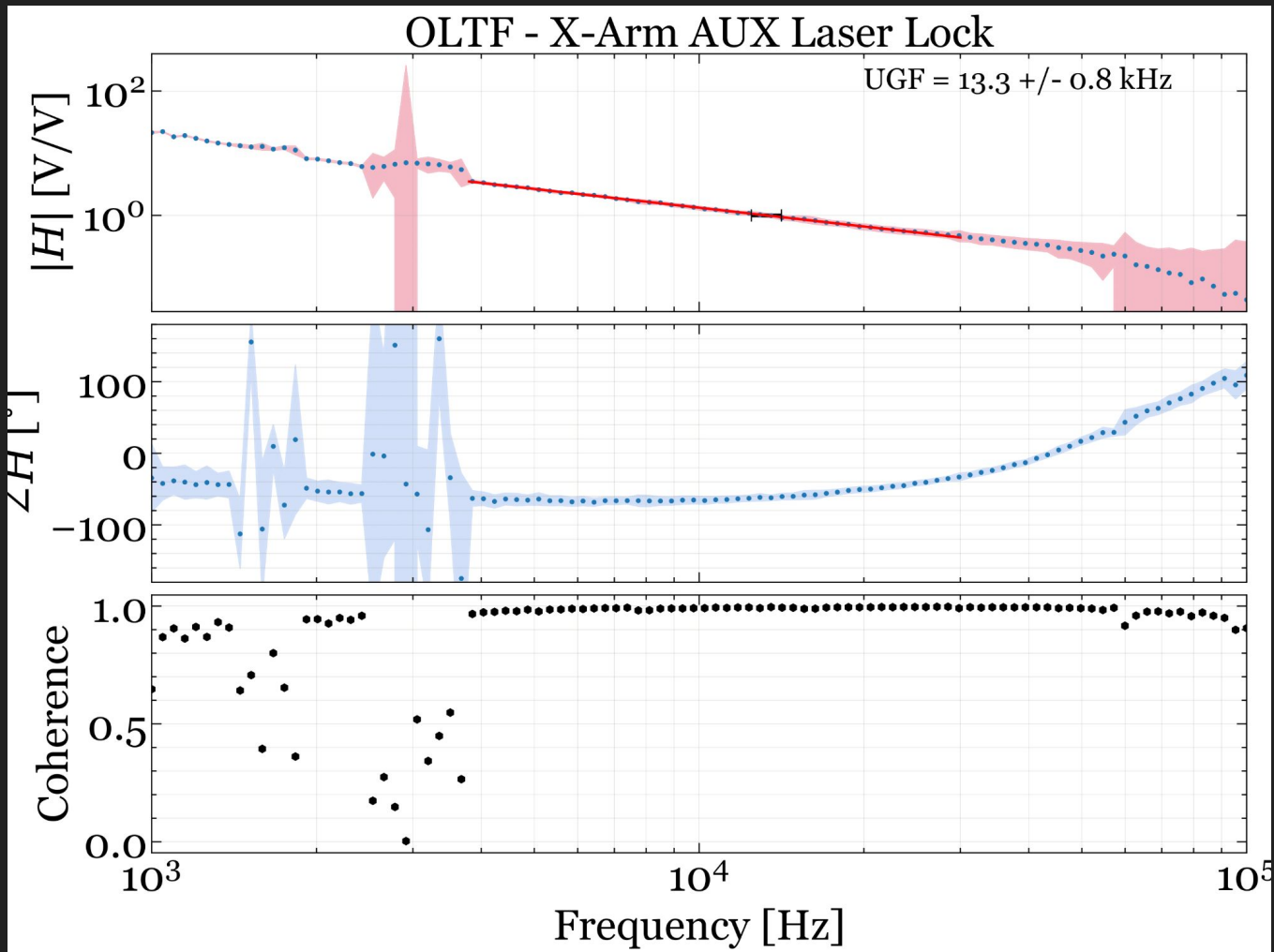
# OLTF - X-Arm AUX Laser Lock



# OLTF - X-Arm AUX Laser Lock







# Ongoing Work

- **Correlating UGF and optical gain**
- **Measuring drift of the UGF and identifying other systematics**
- **Getting the Red Pitaya on the Wifi, so we can take measurements from the control room!**

# Thank you!

I would like to thank my mentors, Paco, Anchal, and Rana, for their continuous guidance, support, and encouragement.

Thank you also to Alan J. Weinstein and all the LIGO mentors for this excellent program, as well as the LIGO Collaboration and the NSF.

Thanks and goodbye to all the great folks at the 40m lab - Yehonathan, Jancarlo, Tega, and Yuta!

**Caltech**



# Works Cited

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