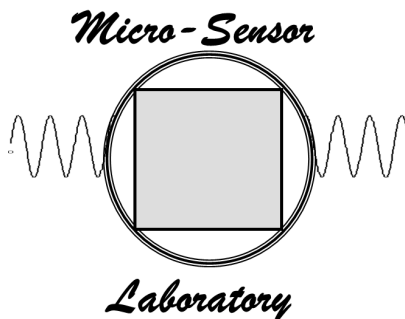




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A Microresonator Based Laser Velocity Sensor

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AIAA SciTech Forum, 8-12 January 2018, Kissimmee, Florida

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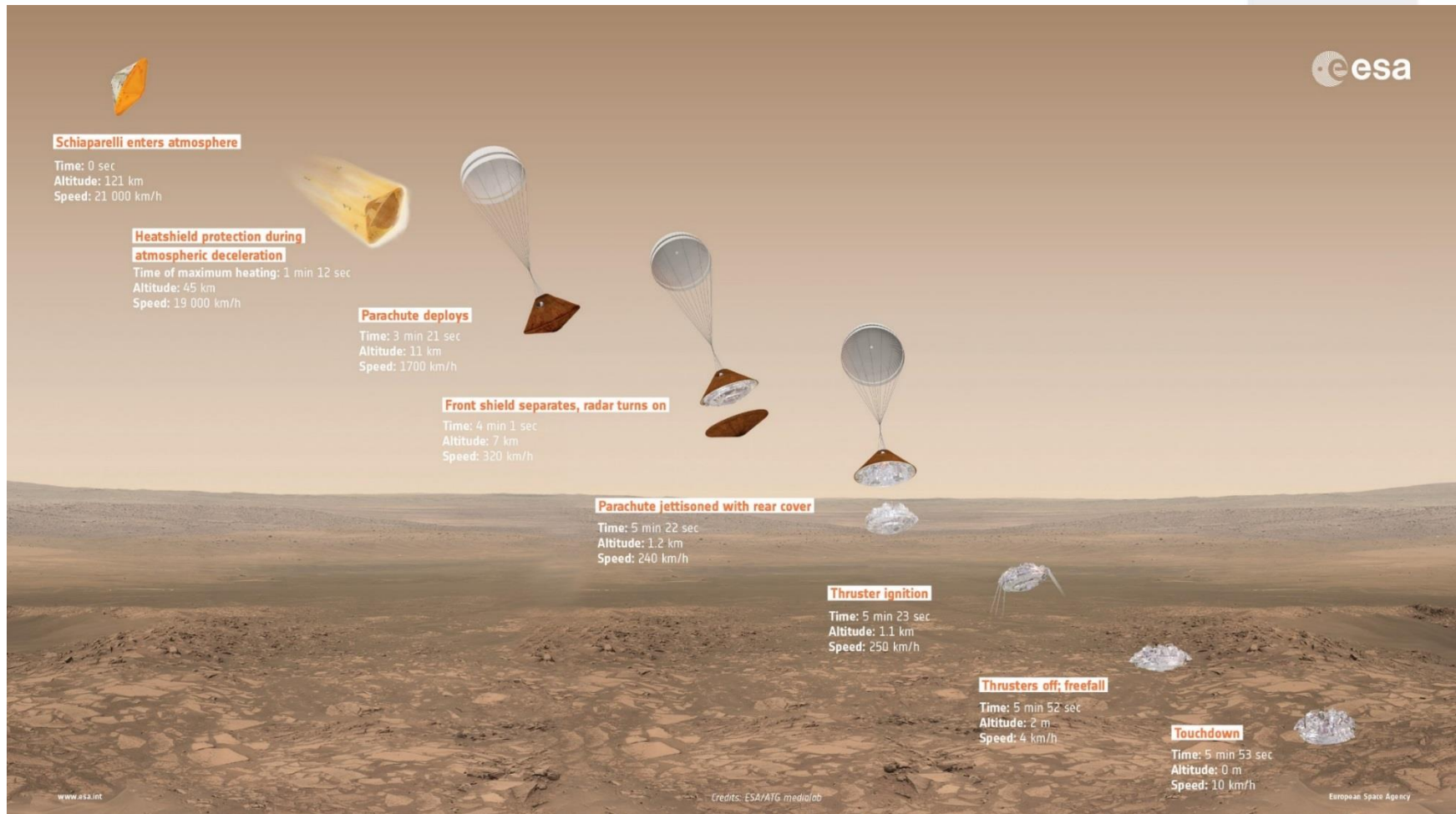
A Microresonator Based Laser Velocity Sensor

- Presentation Outline
 - Project Motivation
 - Measurement Principle
 - Proof of Concept Experiment
 - Signal Processing Algorithm
 - Free Space Coupling
 - Conclusion and Questions

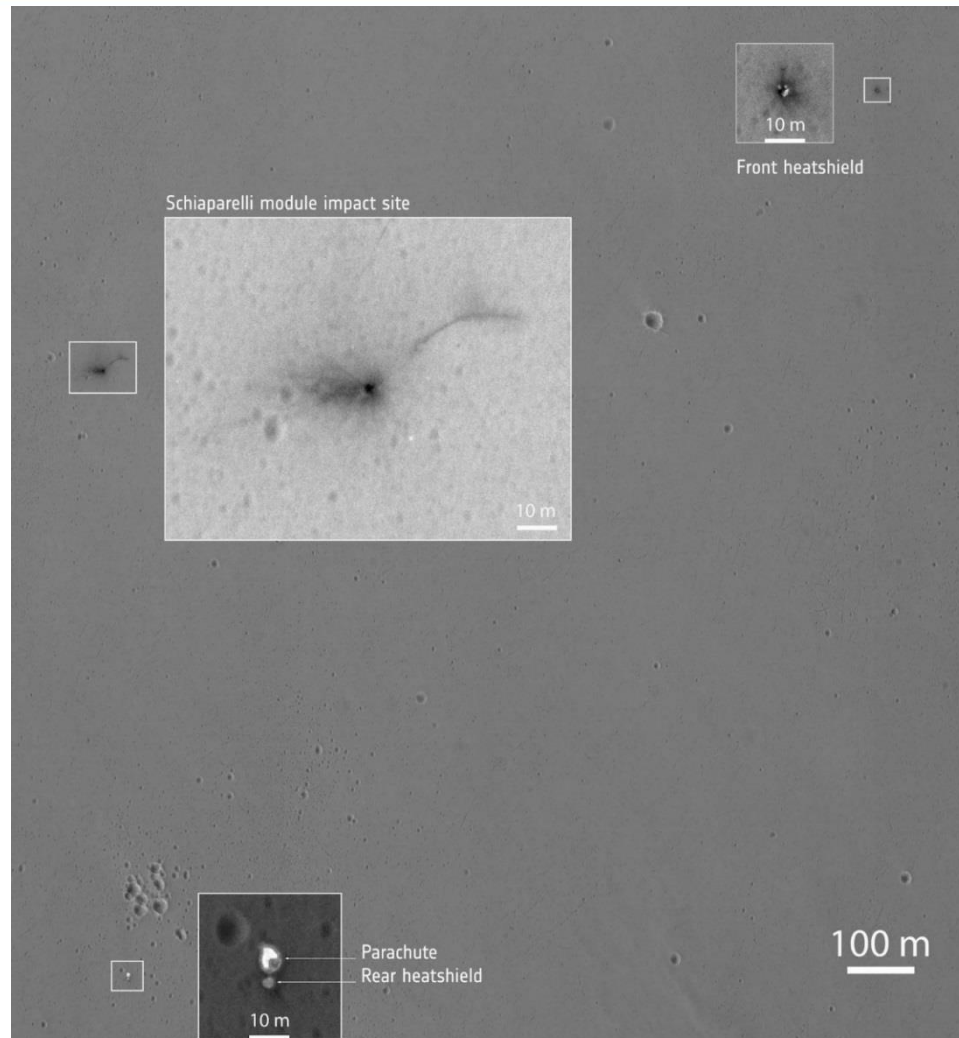
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MOTIVATION

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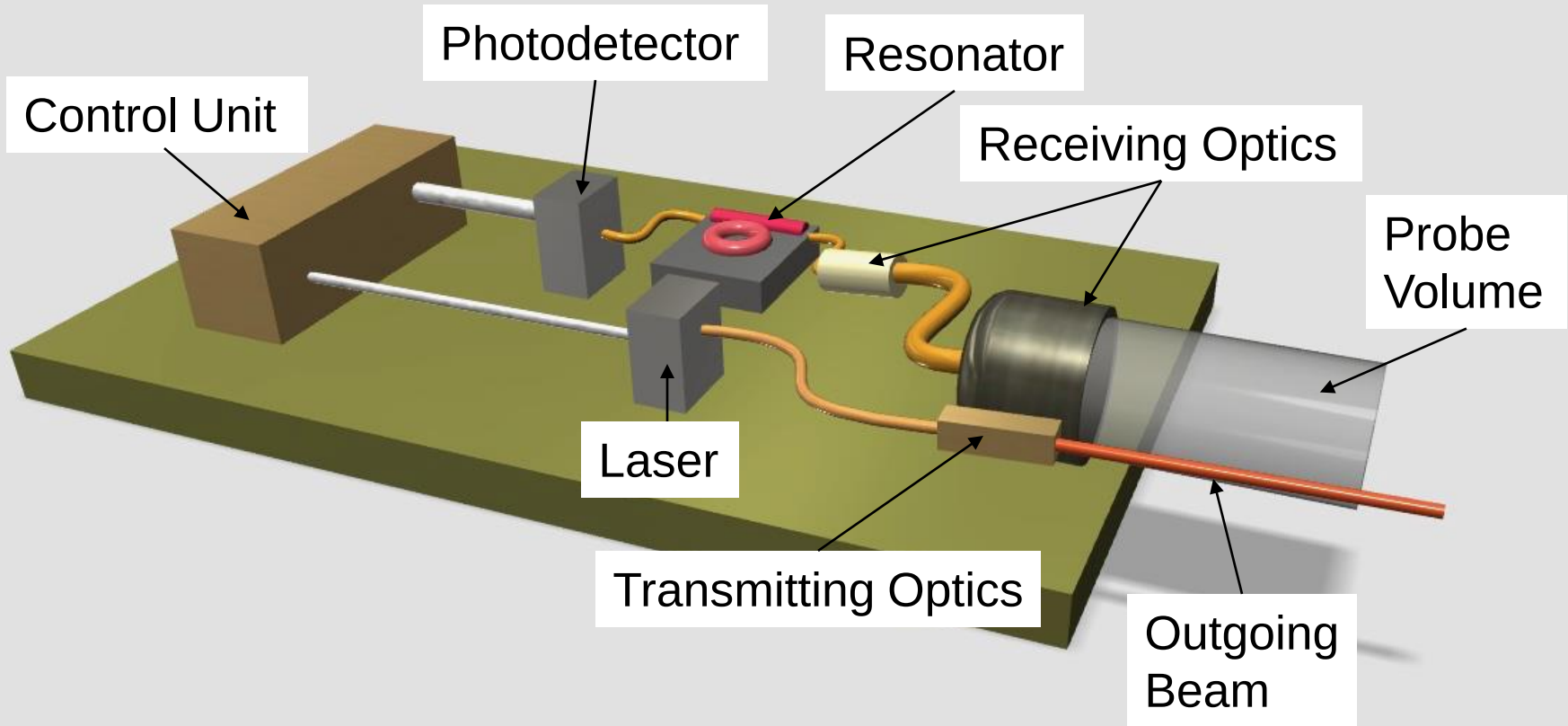
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MEASUREMENT PRINCIPLE

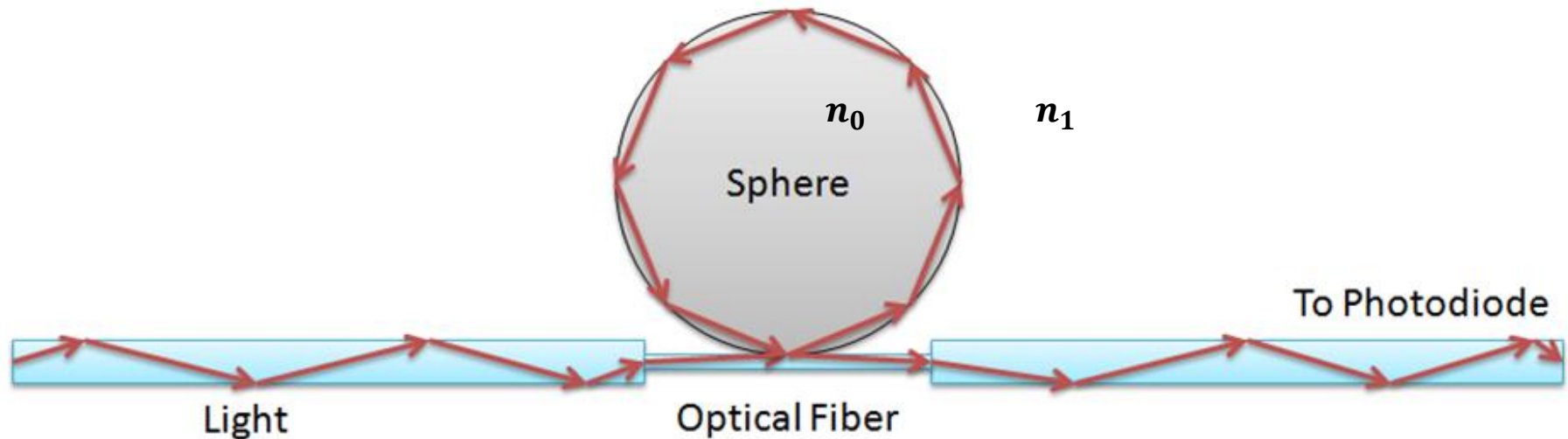
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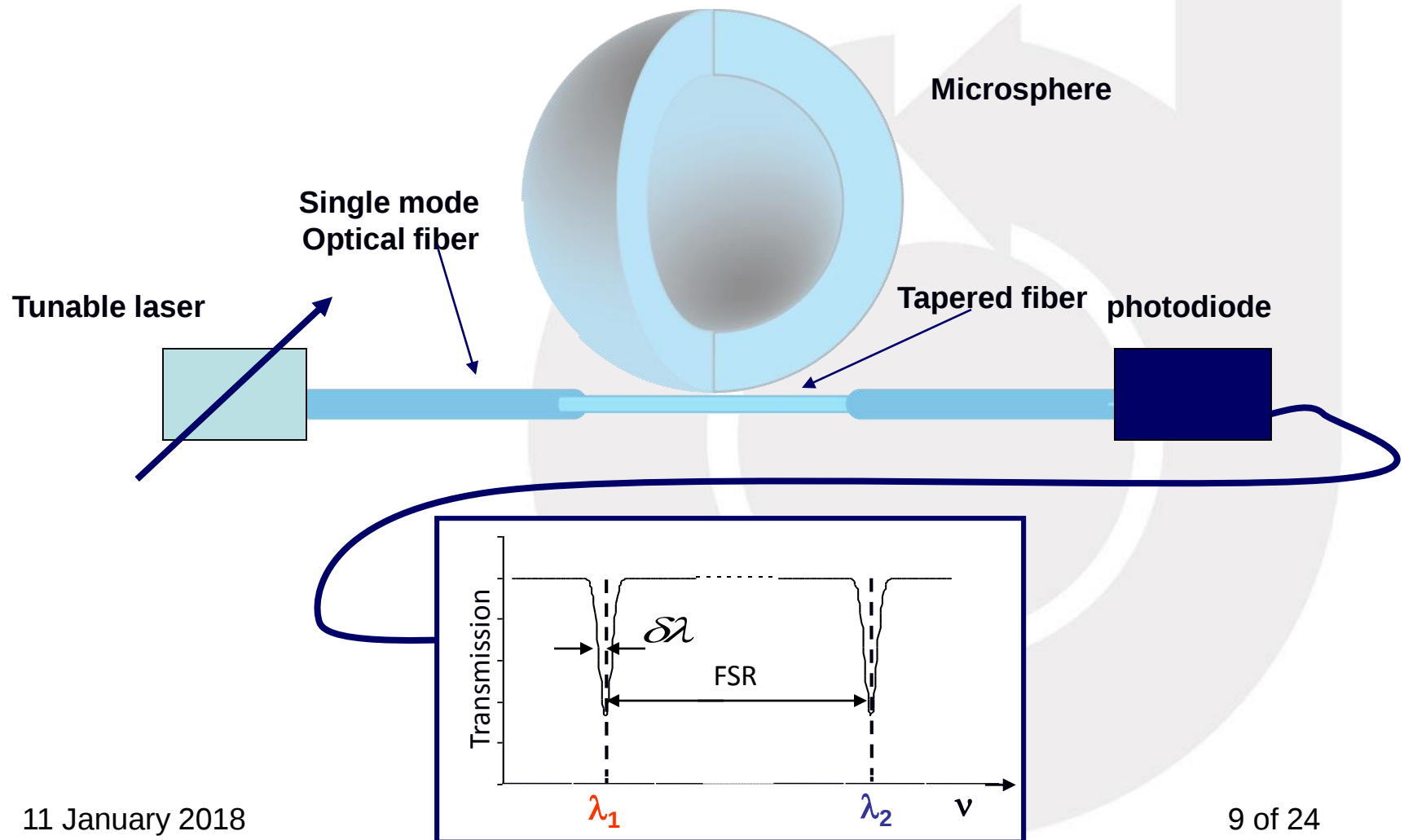
The Whispering Gallery Mode

- Resonance Condition: $2 \pi r n_0 = l \lambda$ for $r \gg \lambda$



- Very High Q-Factor Sensing ($Q = \frac{\lambda}{\delta\lambda} > 10^7$)

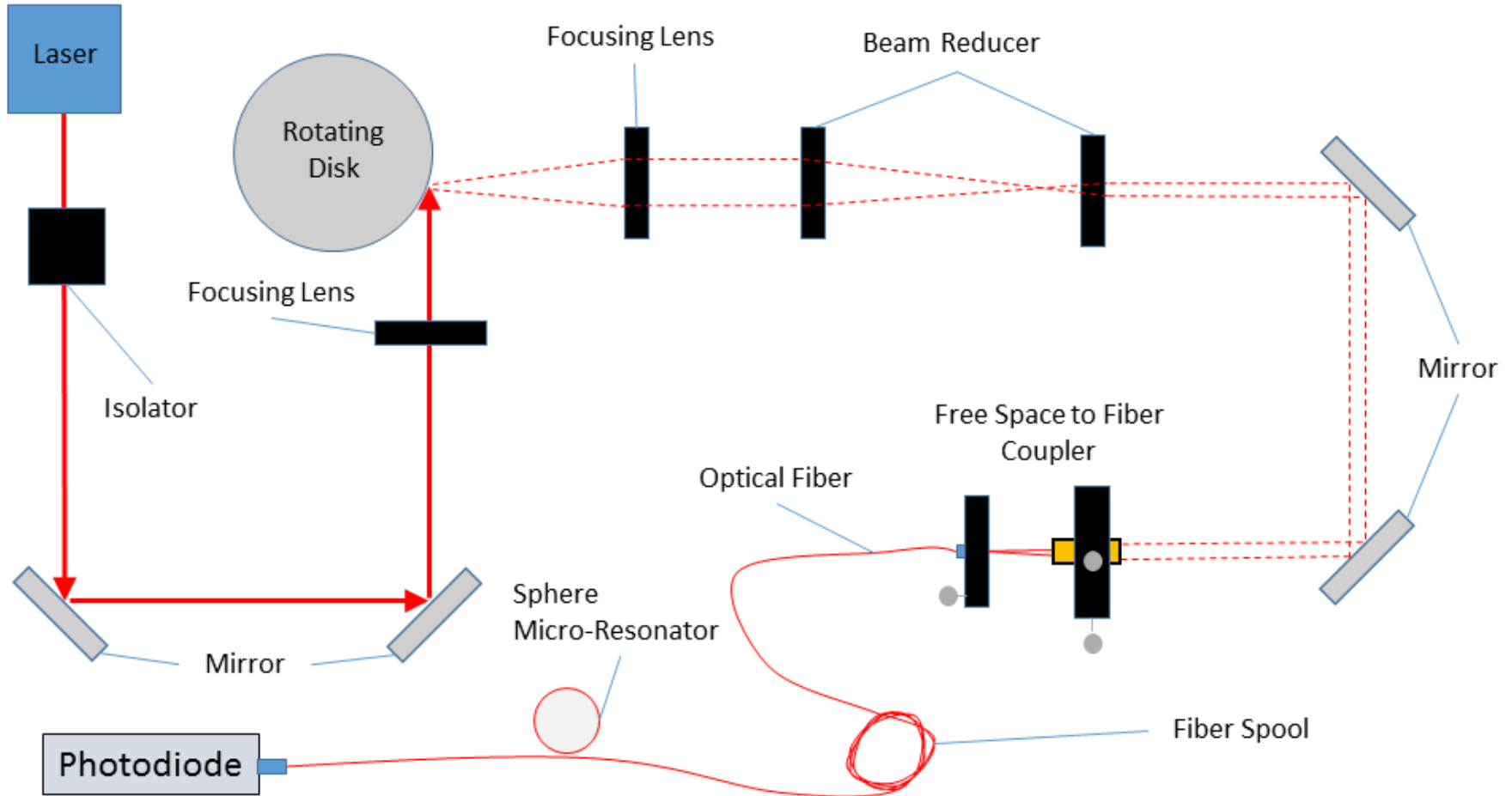
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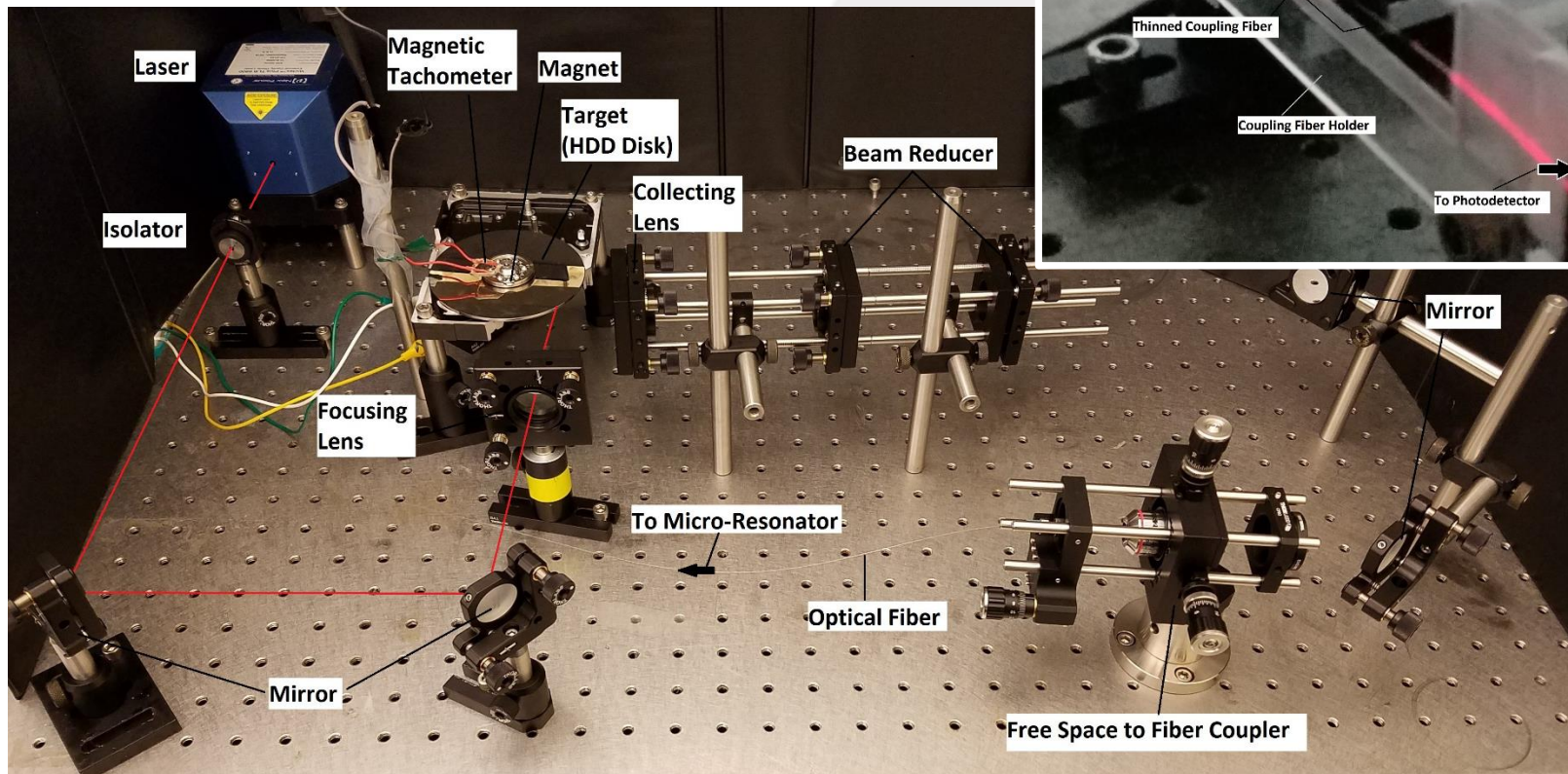
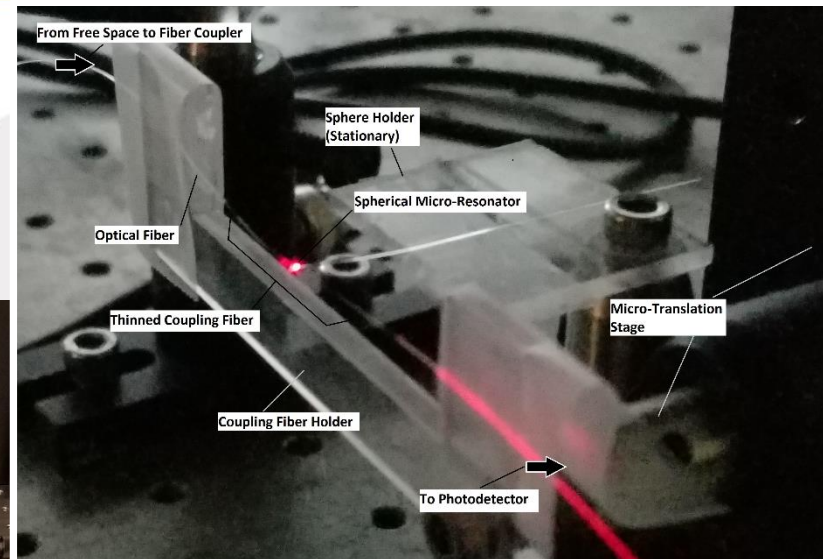
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PROOF OF CONCEPT EXPERIMENT

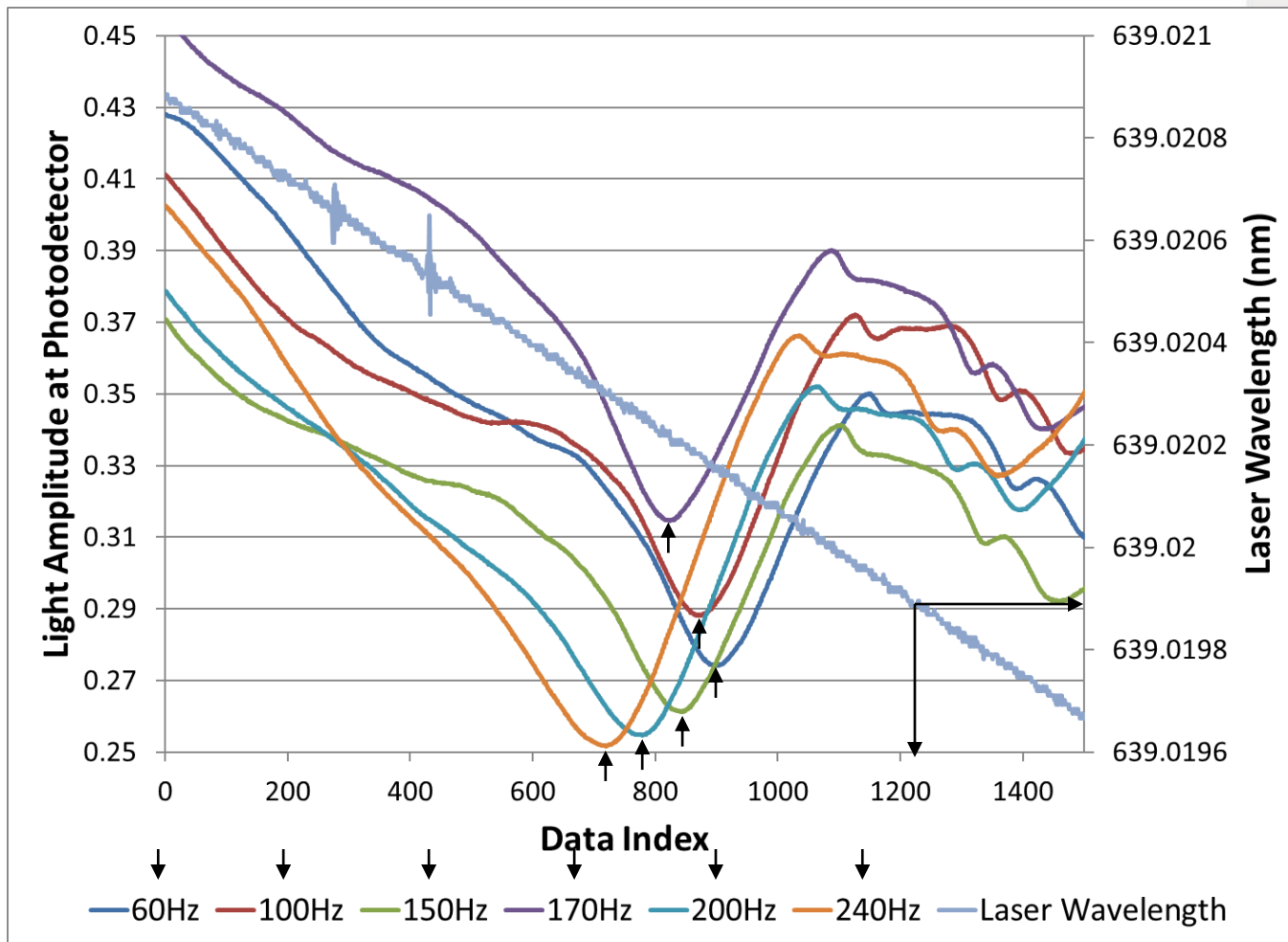
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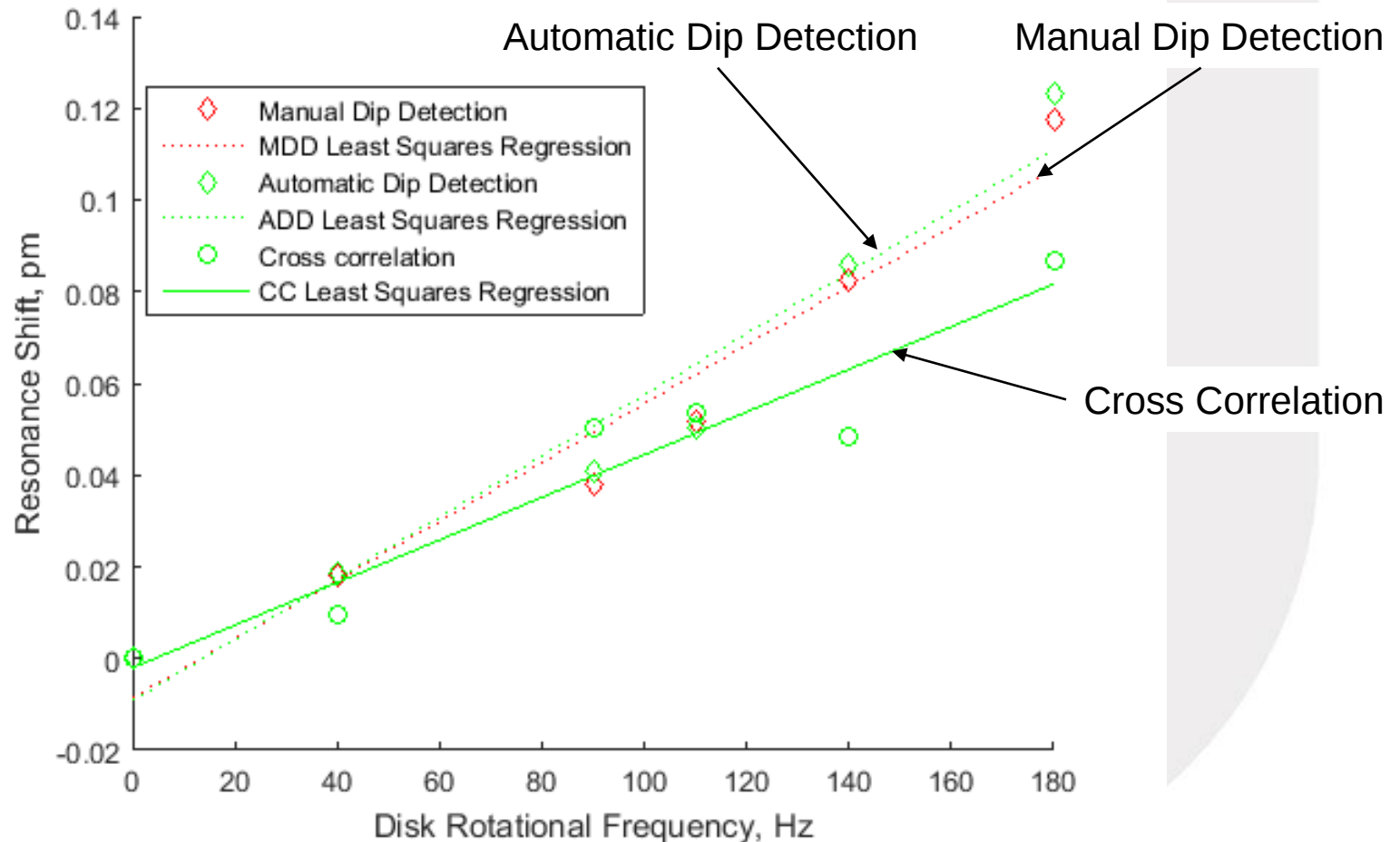
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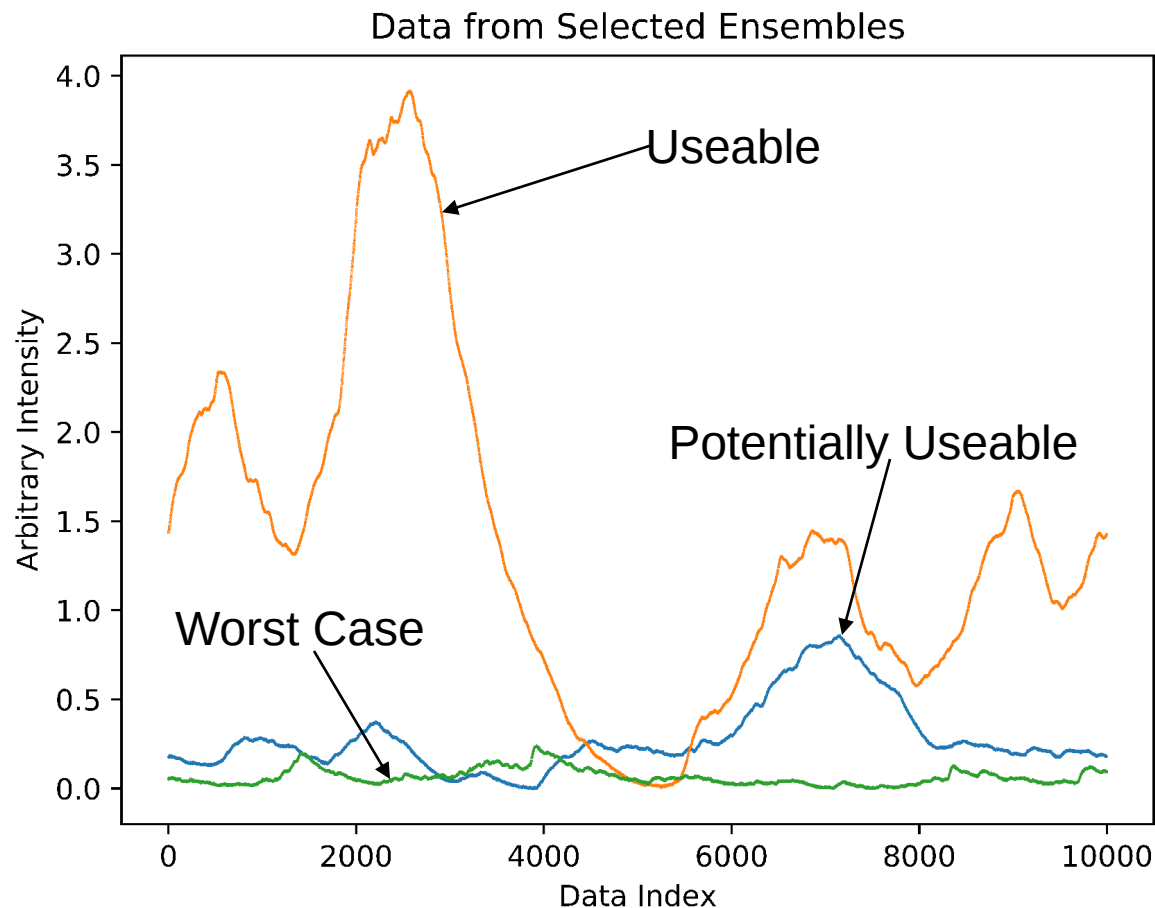
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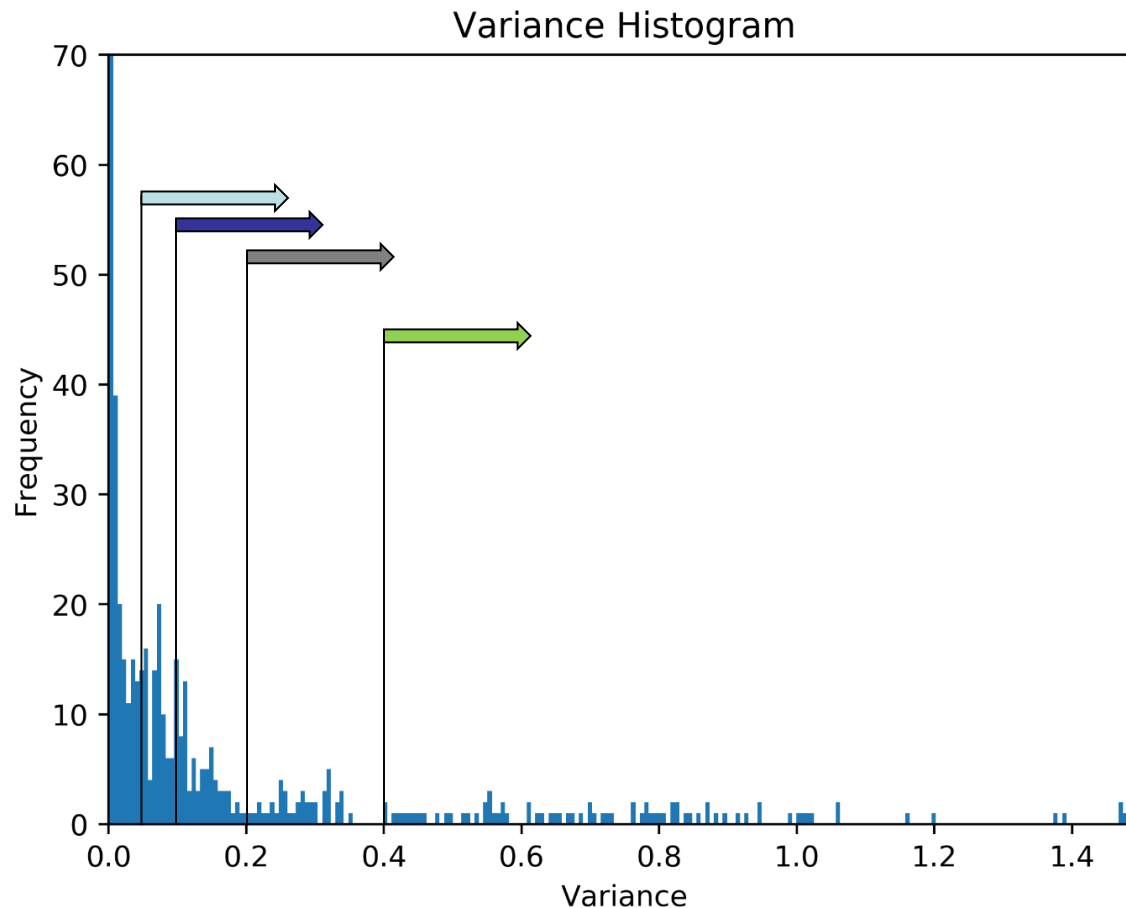
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SIGNAL PROCESSING

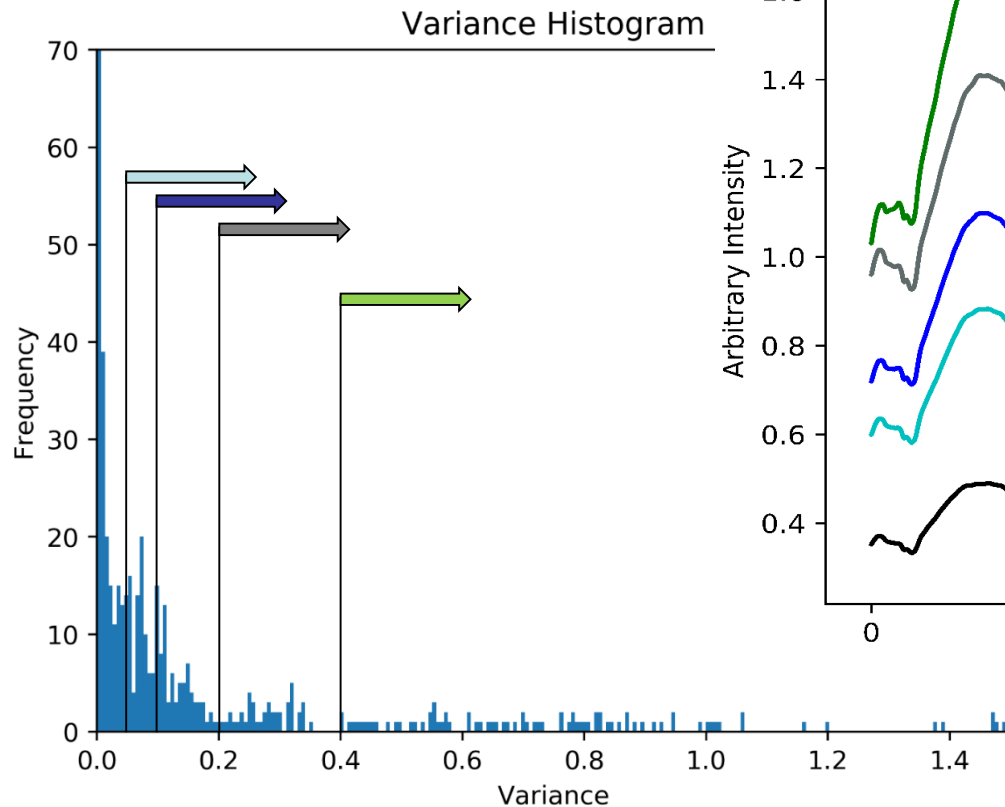
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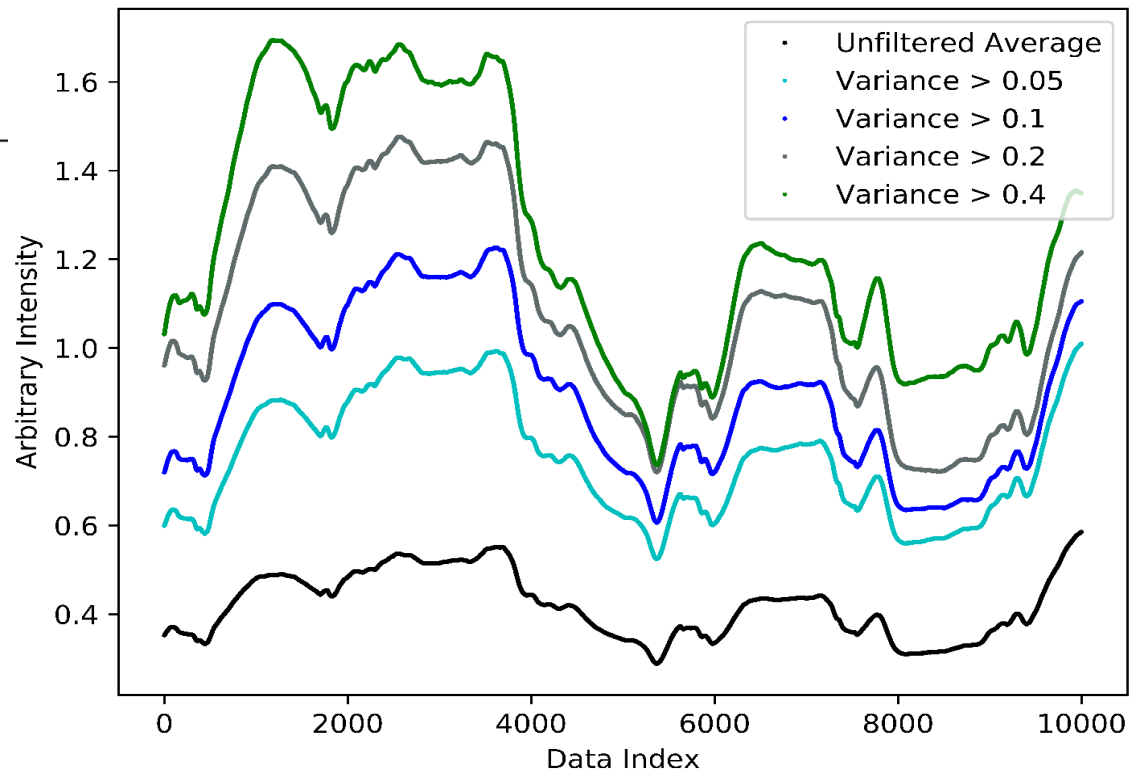
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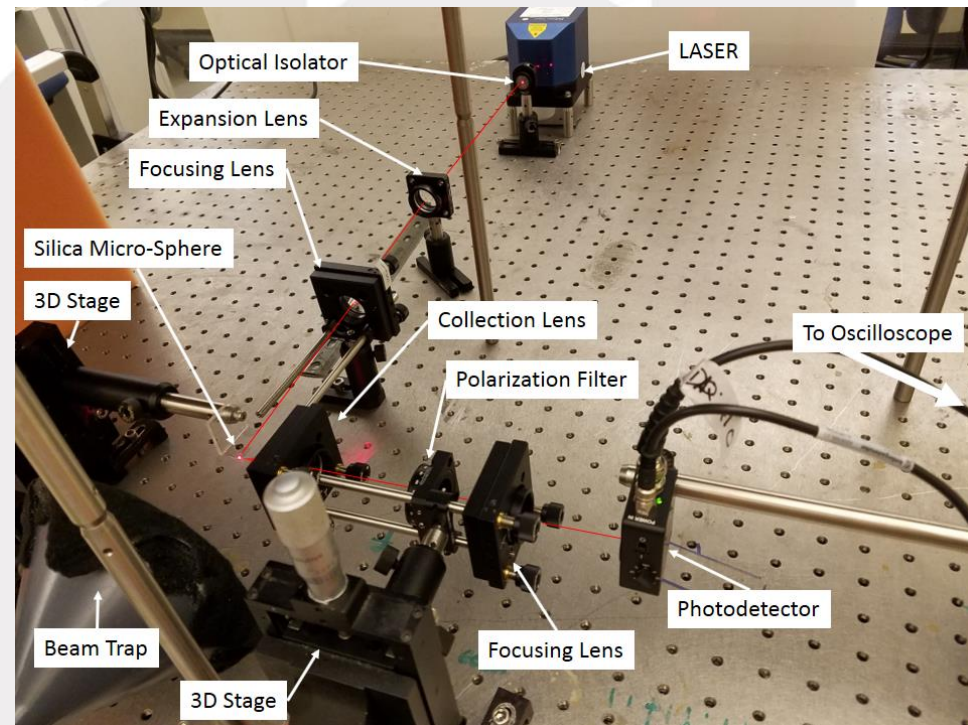
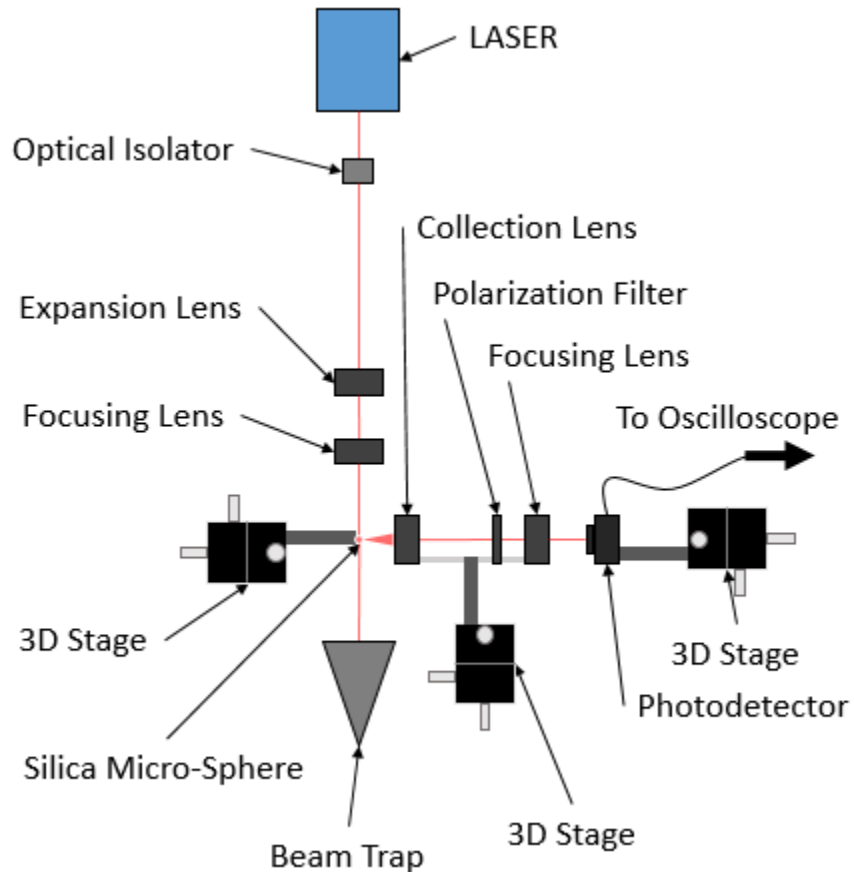
Raw Data and Ensemble Averages by Variance Cut-Off



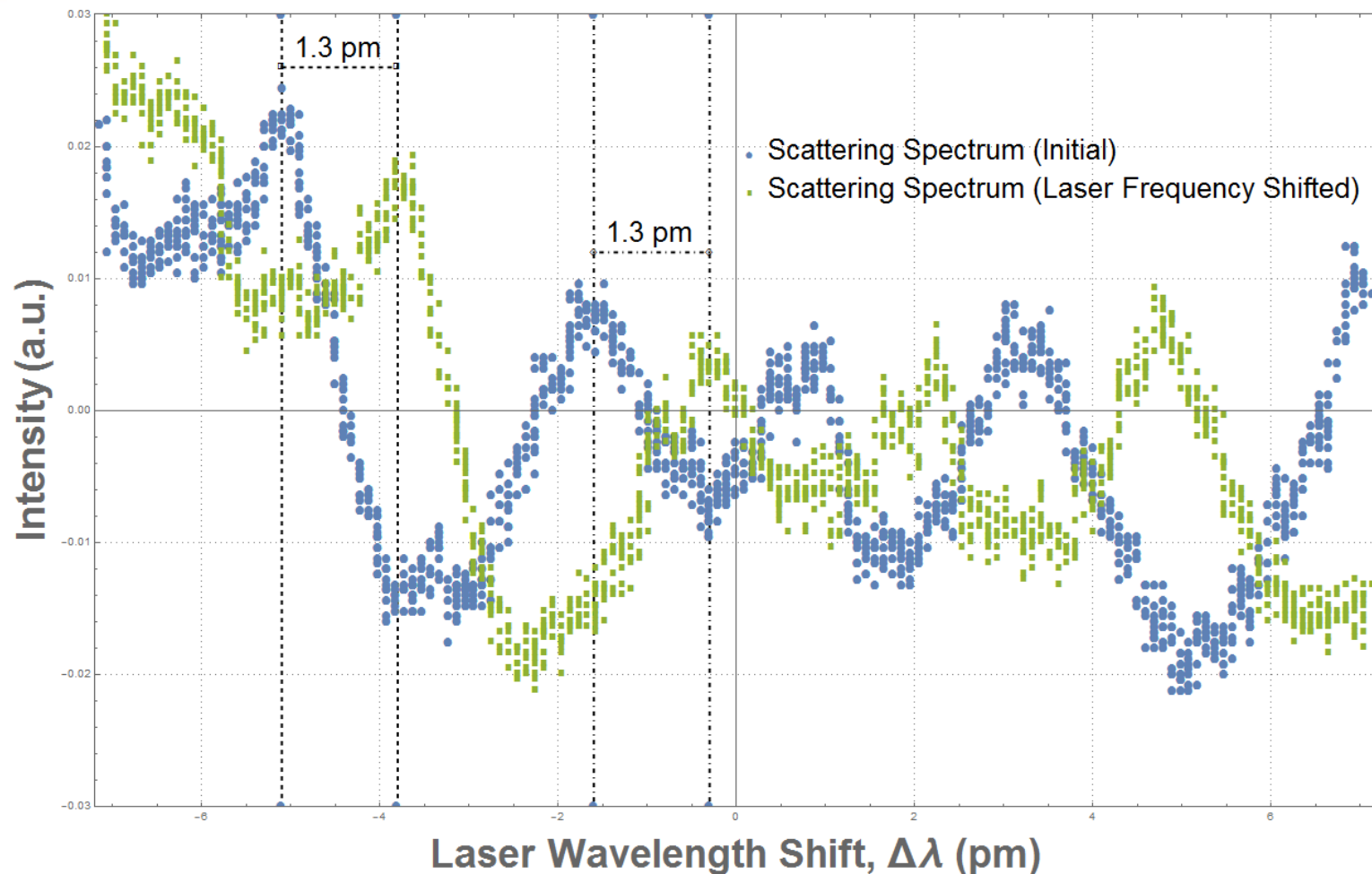
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FREE SPACE COUPLING

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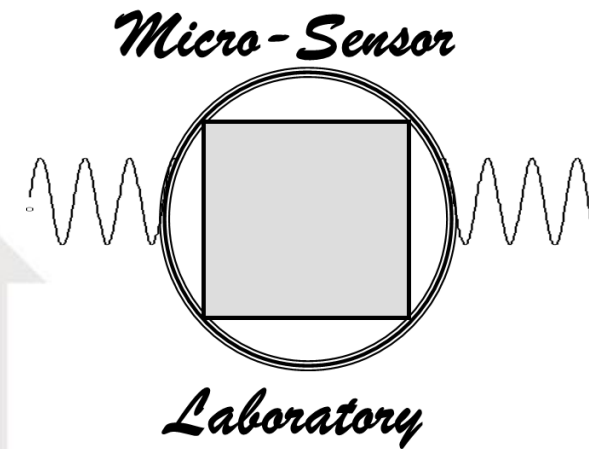
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A Microresonator Based Laser Velocity Sensor

- Conclusions
 - Demonstrated measurement of Doppler-shifts of laser light scattered from a moving target
 - Due to high resonator Q-factors, very small changes in the velocity can be determined
 - Current results indicate a 2.4 m/s velocity resolution
 - Demonstrated a signal processing approach that may mitigate the effect of signal dropout
 - Demonstrated a direct (free-space) coupling approach to further mitigate effect of signal dropout

QUESTIONS?



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