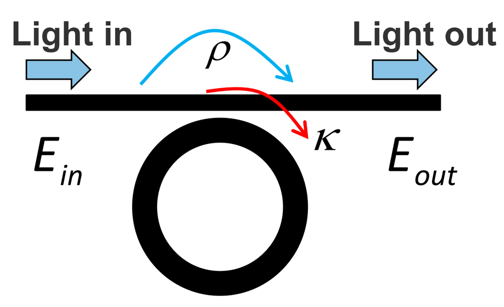
Ming Hsieh Department of Electrical Engineering

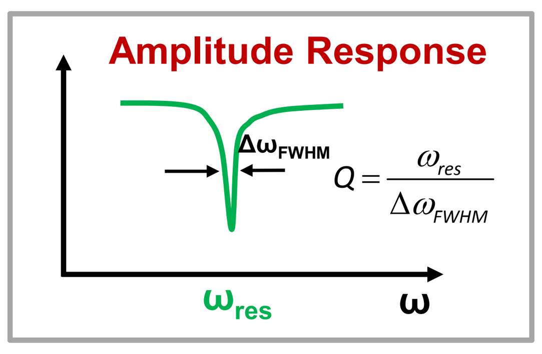
USC Viterbi School of Engineering

Measurement of Quality Factor of Tunable On-Chip Silicon Ring Resonators

Hooman Abediasl and Hossein Hashemi
Ming Hsieh Department of Electrical Engineering

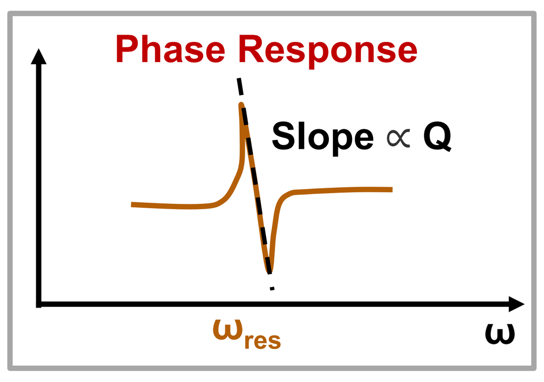
Research Motivation





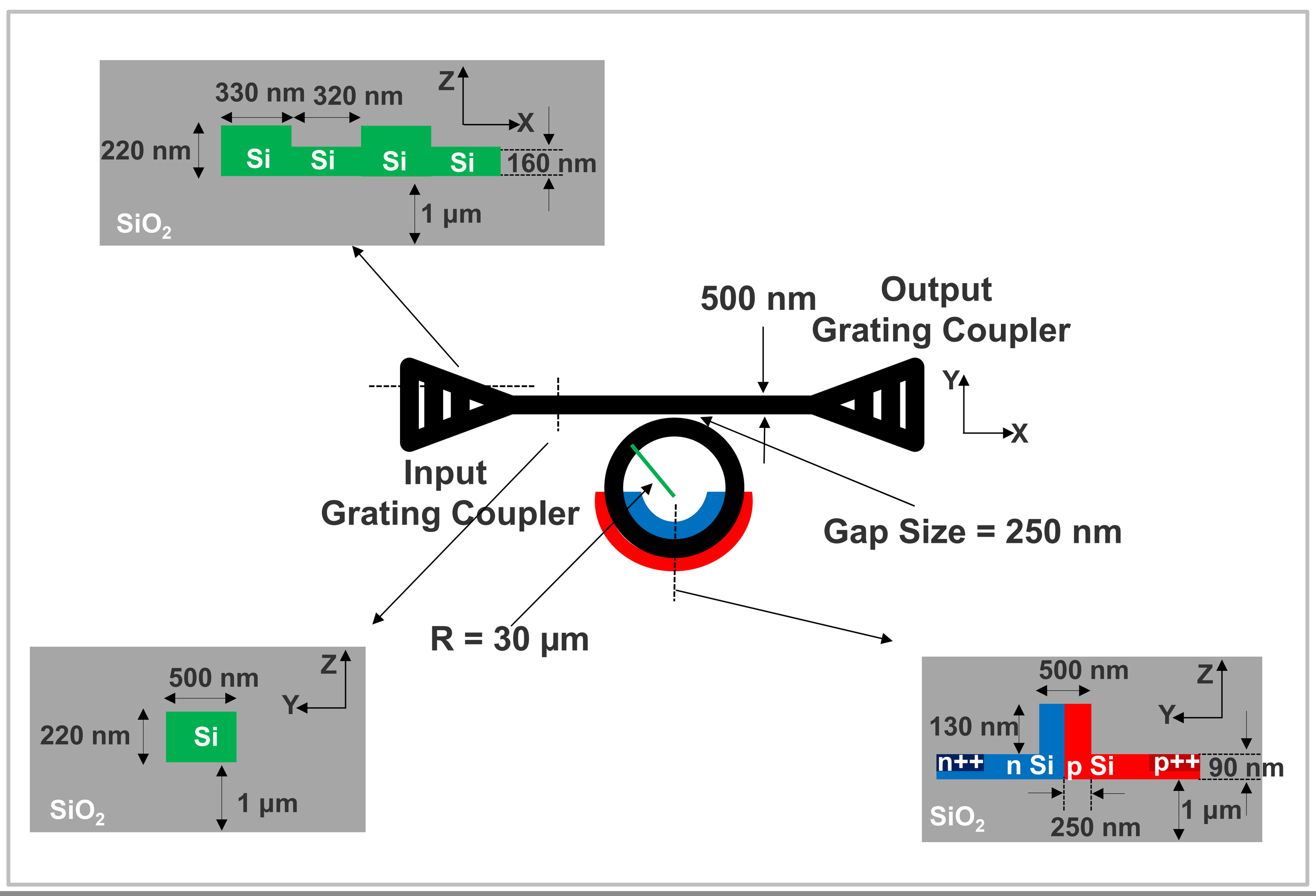
$$\frac{E_{out}(\omega)}{E_{in}(\omega)}=\frac{\alpha-\rho e^{-i\delta(\omega)}}{\alpha\rho-e^{-i\delta(\omega)}}$$

- α: Round trip field loss
- ρ: In-out field transmission
- $\delta(\omega)$: Round trip phase shift

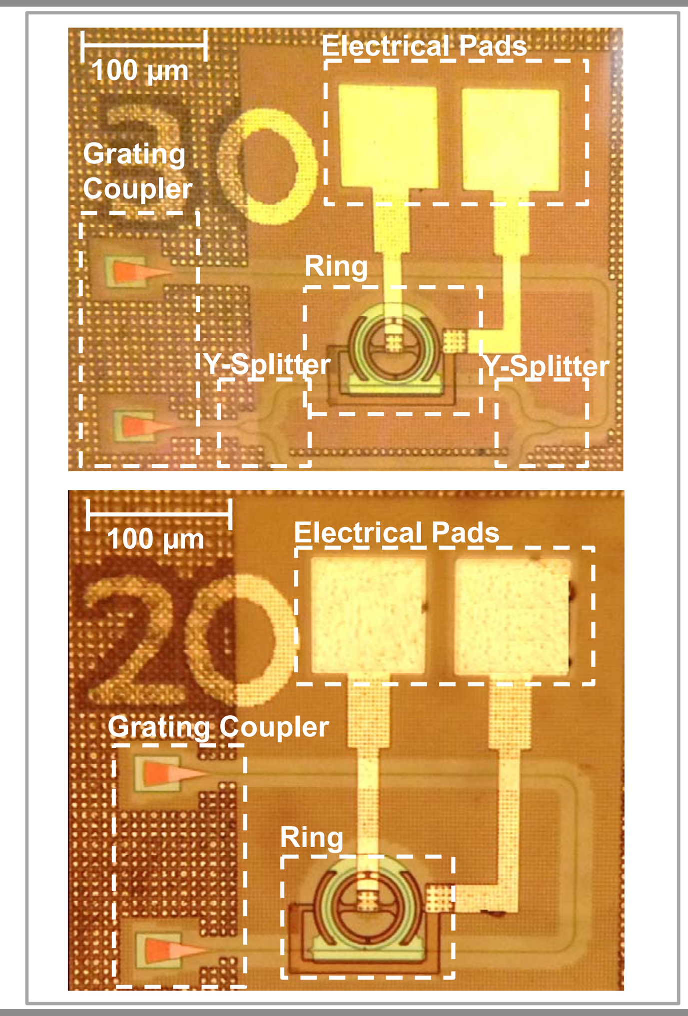


$$Q=(2\pi)^2\frac{n_{eff}R}{\lambda_{res}}\frac{\alpha\rho}{1-(\alpha\rho)^2}$$

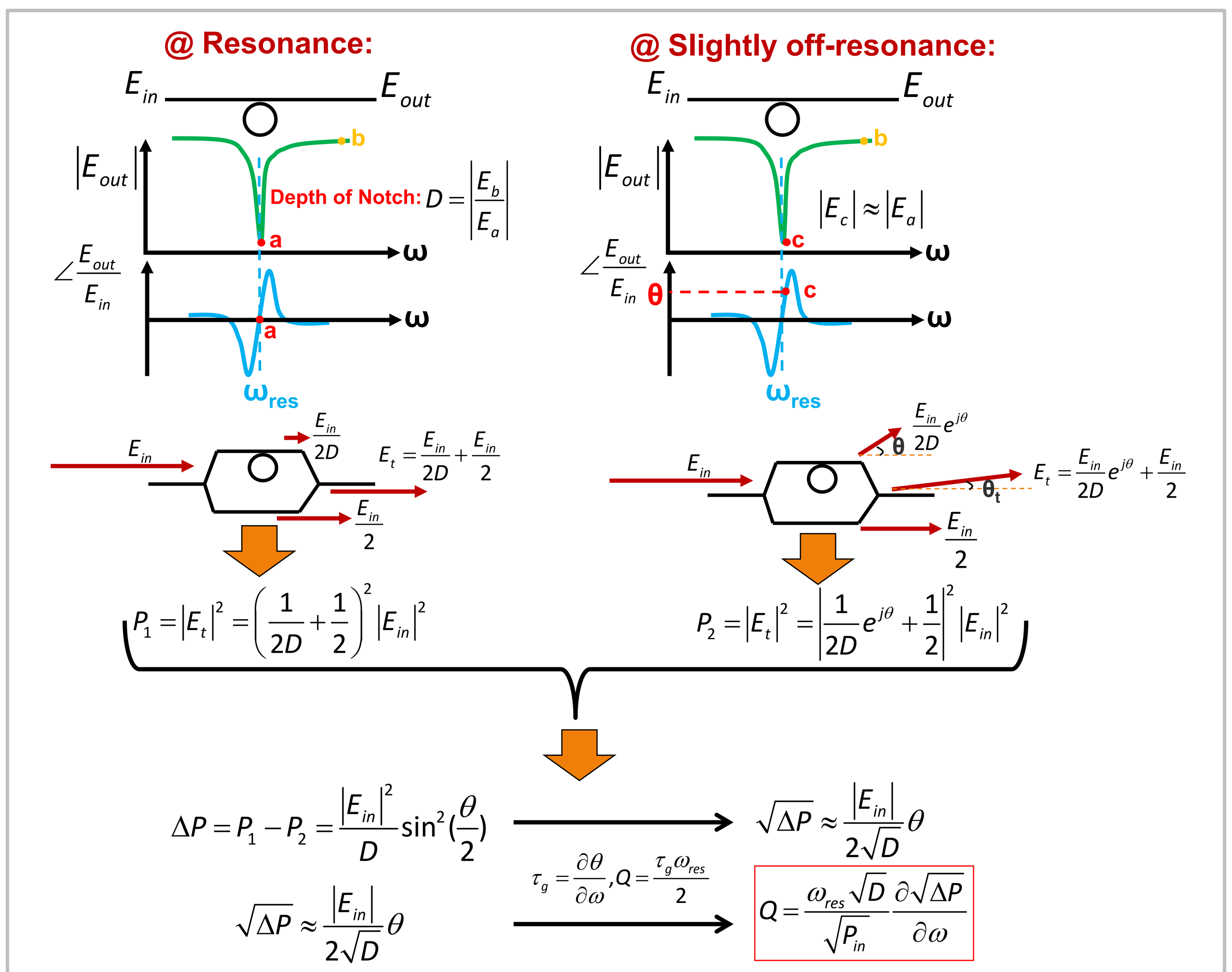
Ring Resonator With PN Modulator



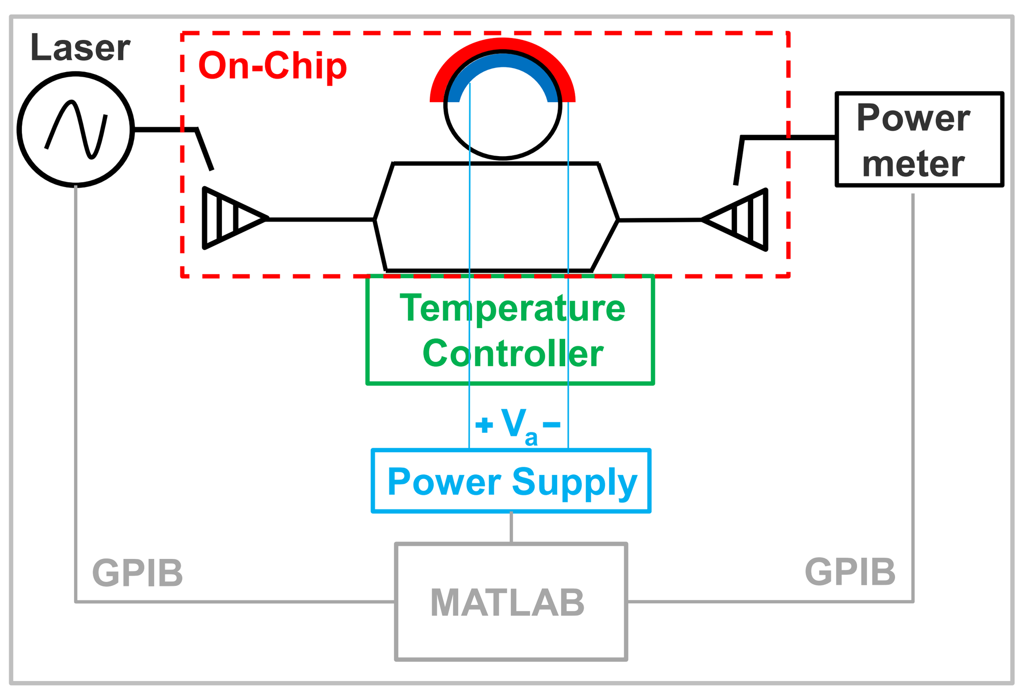
Chip Photo

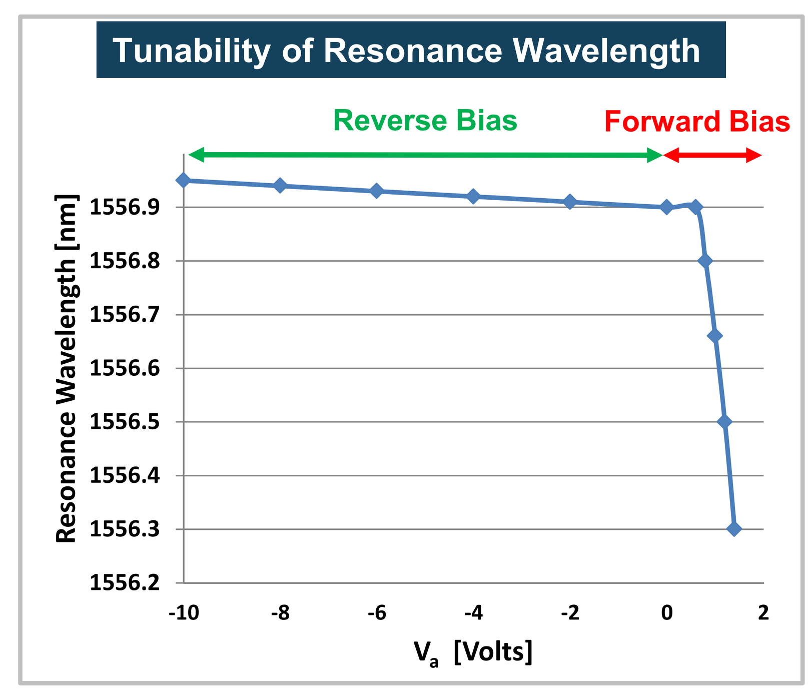


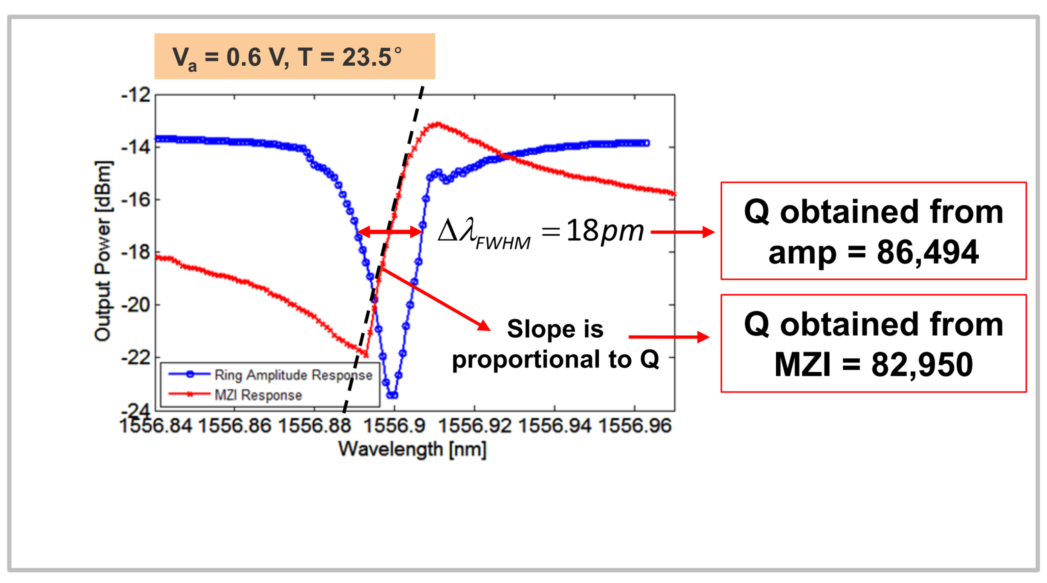
Q-Measurement Using Phase To Amplitude Conversion

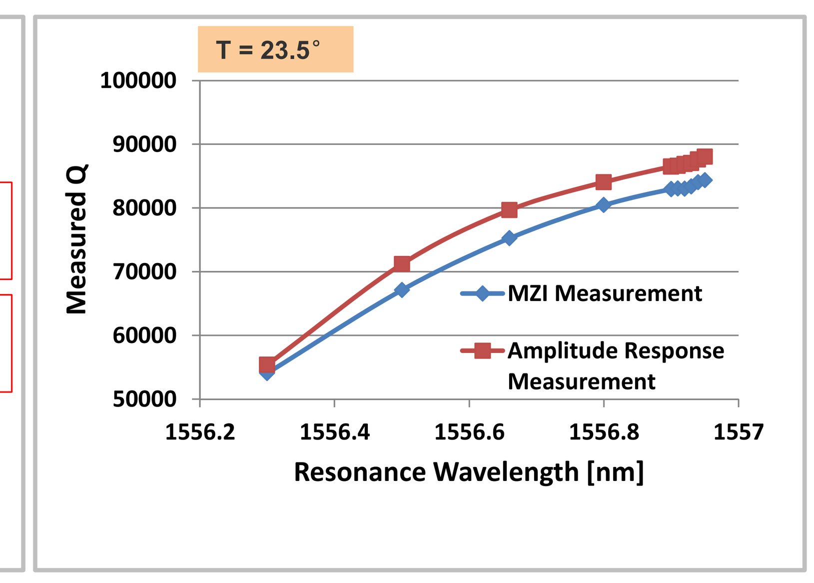


Measurement Results

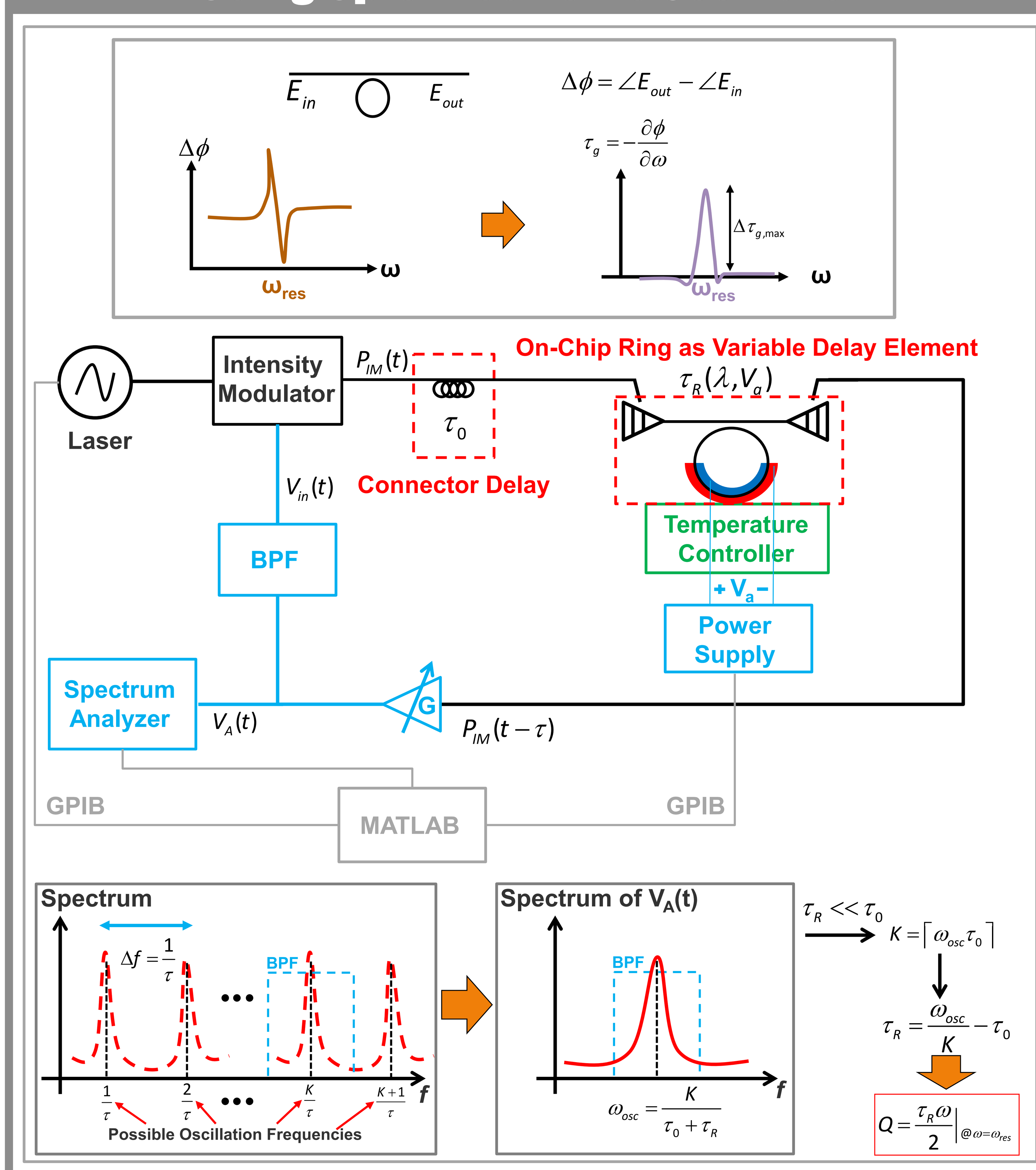




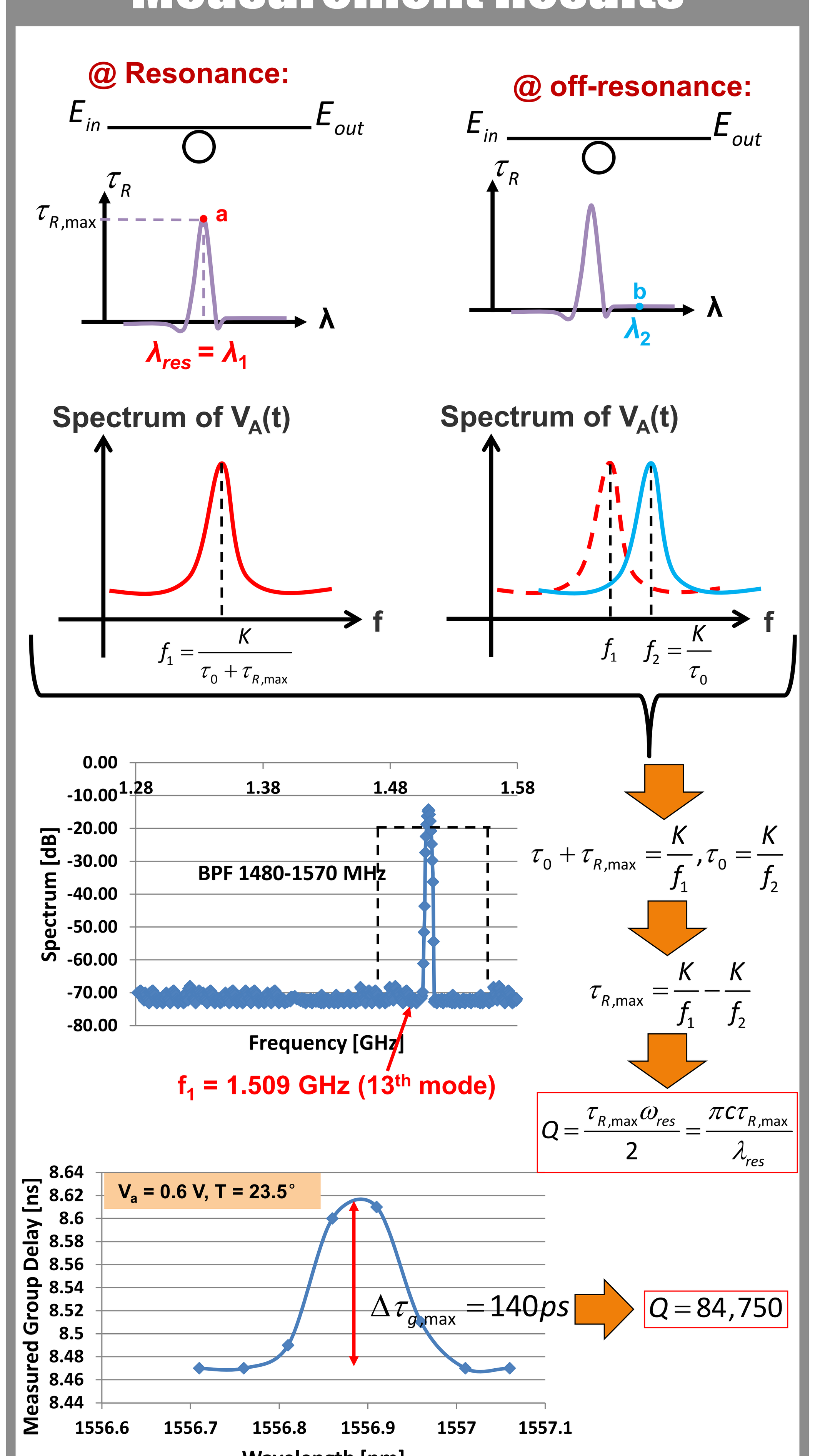




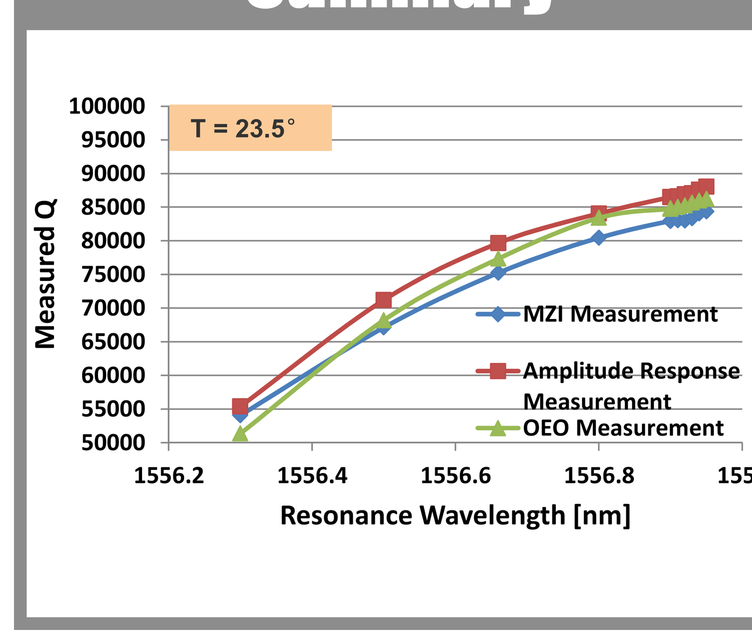
Q-Measurement Using Opto-Electronic Oscillator



Measurement Results



Summary



Conclusion

- Various techniques are used to measure the quality factor of on-chip tunable Silicon micro-resonators in the 1556.3-1556.95nm range to be 51,000-88,000.

Future Work

- Utilize compact tunable Silicon micro-resonators as variable phase shifters and variable attenuators in large-scale monolithic phased arrays.

Contact: abediasl@usc.edu, hosseinh@usc.edu

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