

Understanding Lateral Tunneling Accelerometer and The Micromachining Process

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Sponsor: Institute for Collaborative Biotechnologies



Outline Presentation

- Project and Goals
 - Introduction
 - Types of Accelerometers
 - Micro Fabrication Process
 - Actual Pictures
 - Experimental Testing
 - Results
 - Summary
 - Future plans
- 

Project Goals

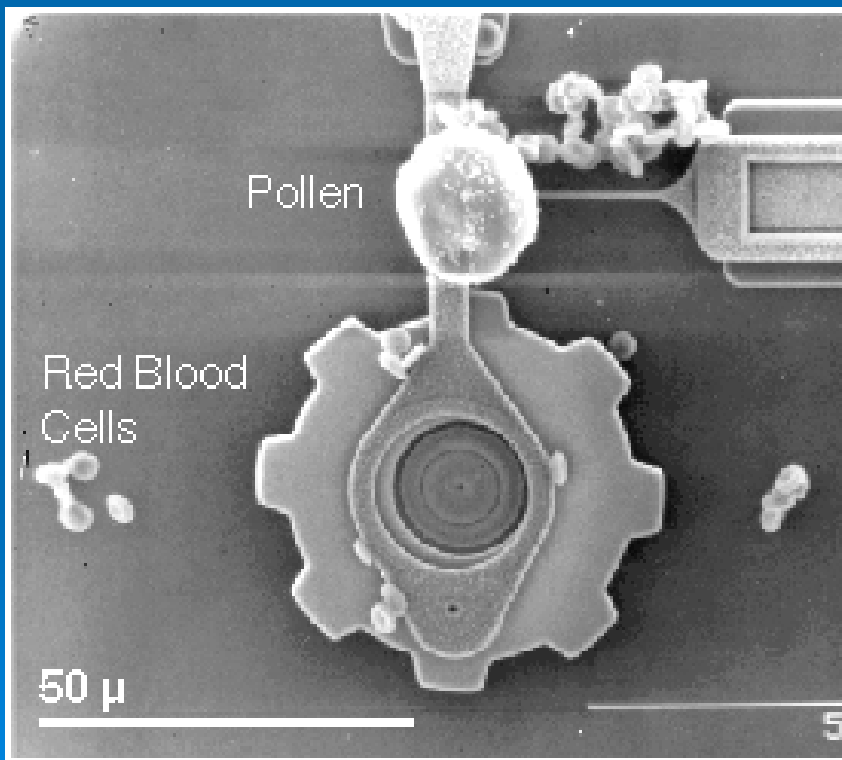
- Getting familiar with MEMS principles
- Characterization of different configurations of lateral tunneling accelerometers by interferometer technique
- Understanding the physics of the quantum mechanics phenomena of “tunneling current” and the importance of using it in ultra high sensitive devices
- Overview of MEMS fabrication process: SOI PROCESS



Introduction

➤ What is MEMS?

Micro Electro Mechanical Systems



Courtesy of Sandia National Laboratories

➤ What is an accelerometer?

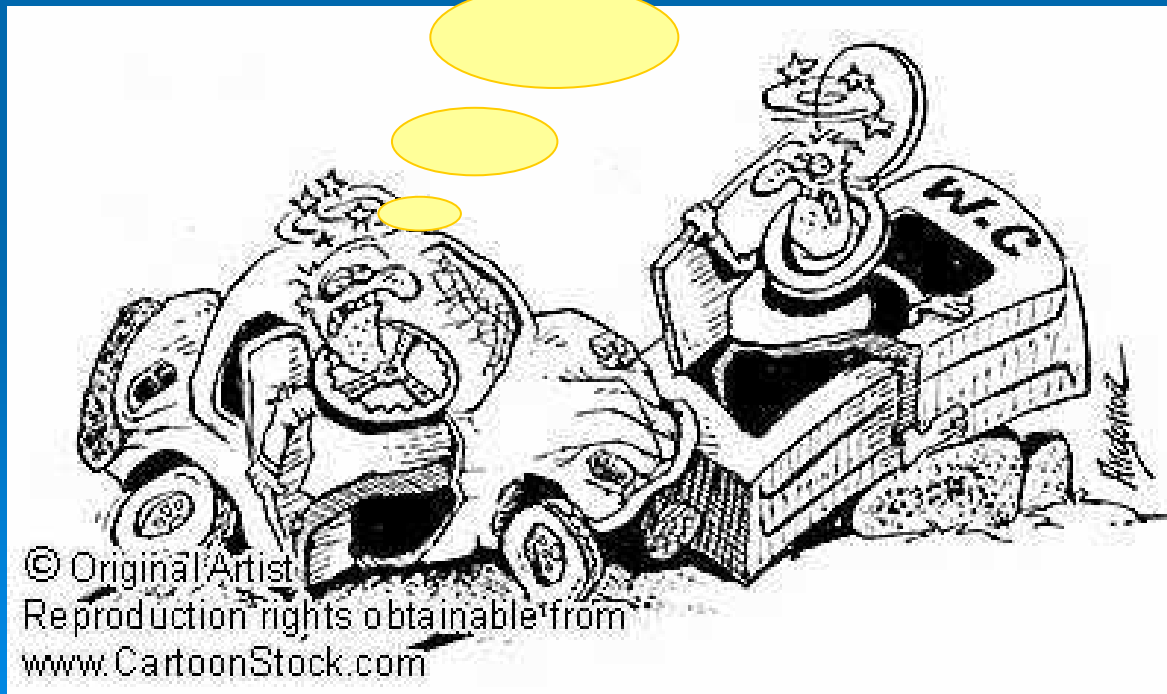
A sensor that detects changes on velocity

➤ Applications

- Seismology
- Air bag deployment
- Aerospace

One possible application

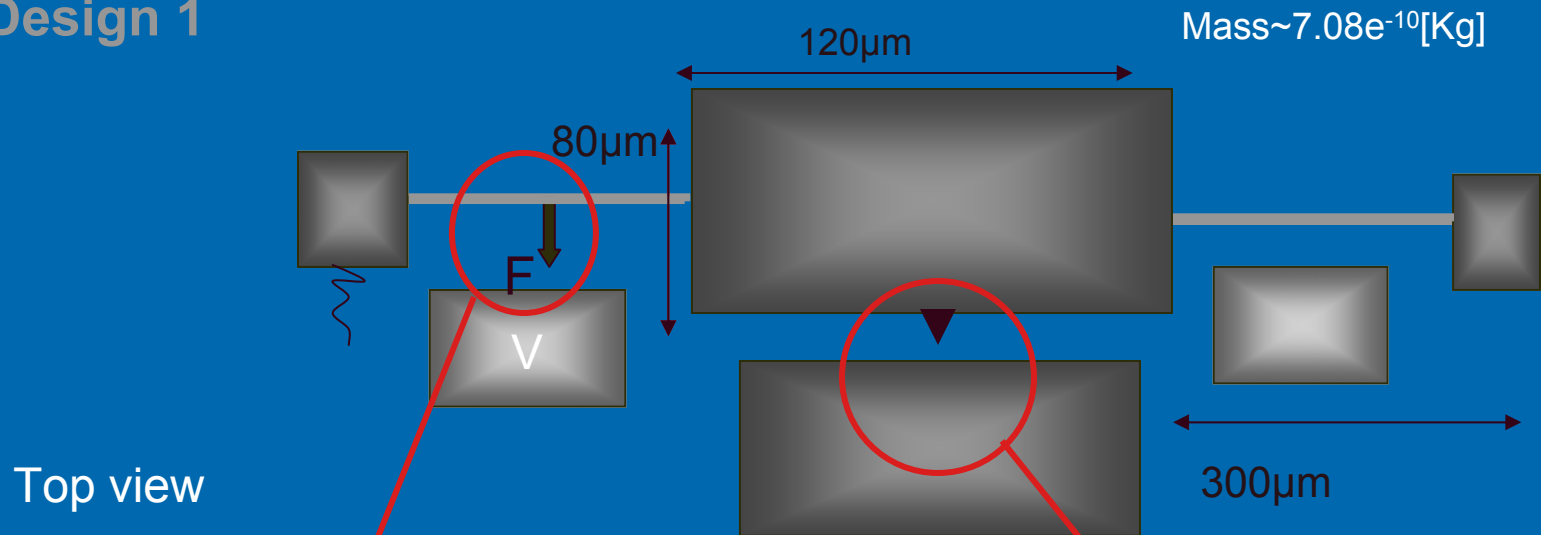
I wish I had an
air-bag
deployment in
my car!



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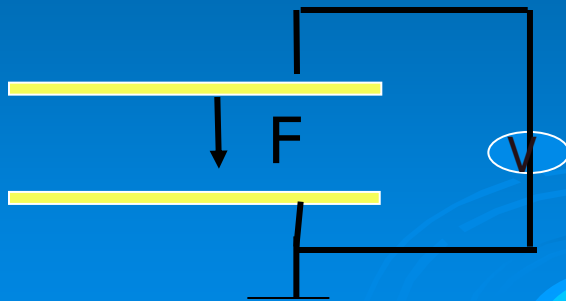
Two Types Of Lateral Tunneling Accelerometer

• Design 1



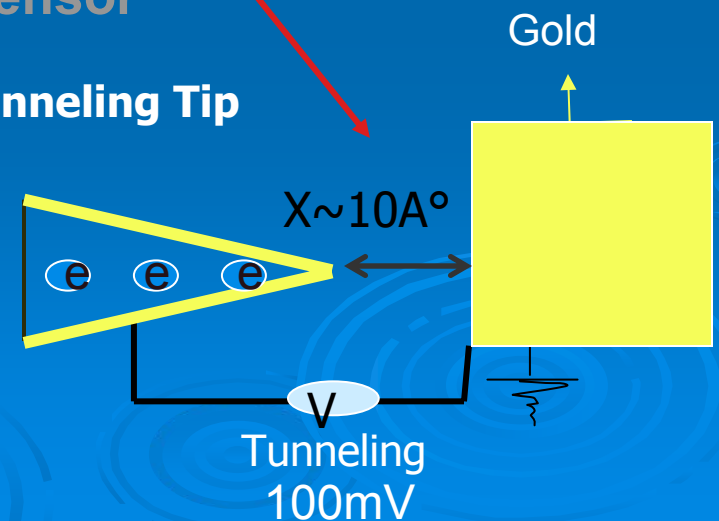
• Actuator 1

* Parallel plates

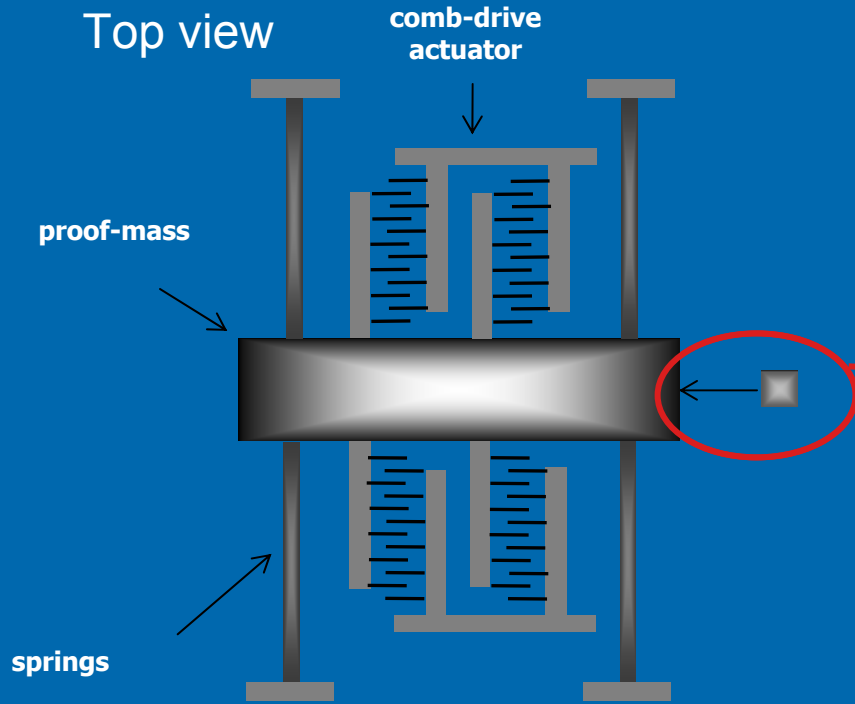


• Sensor

Tunneling Tip

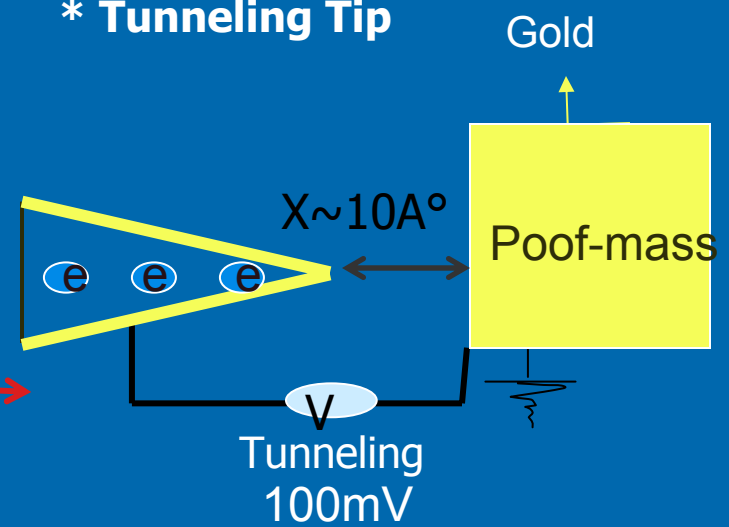


• Design 2



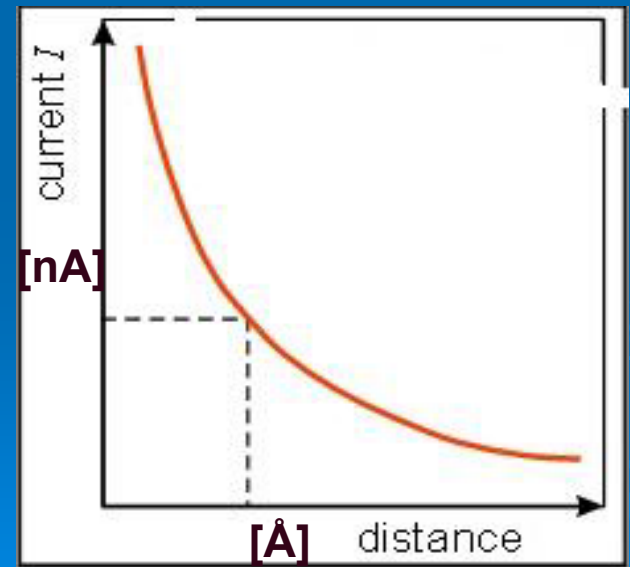
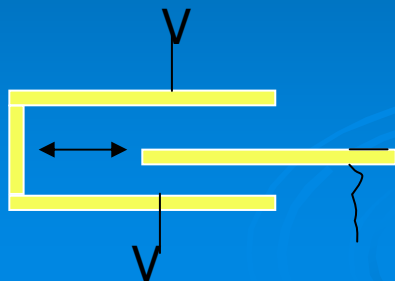
• Sensor

* Tunneling Tip



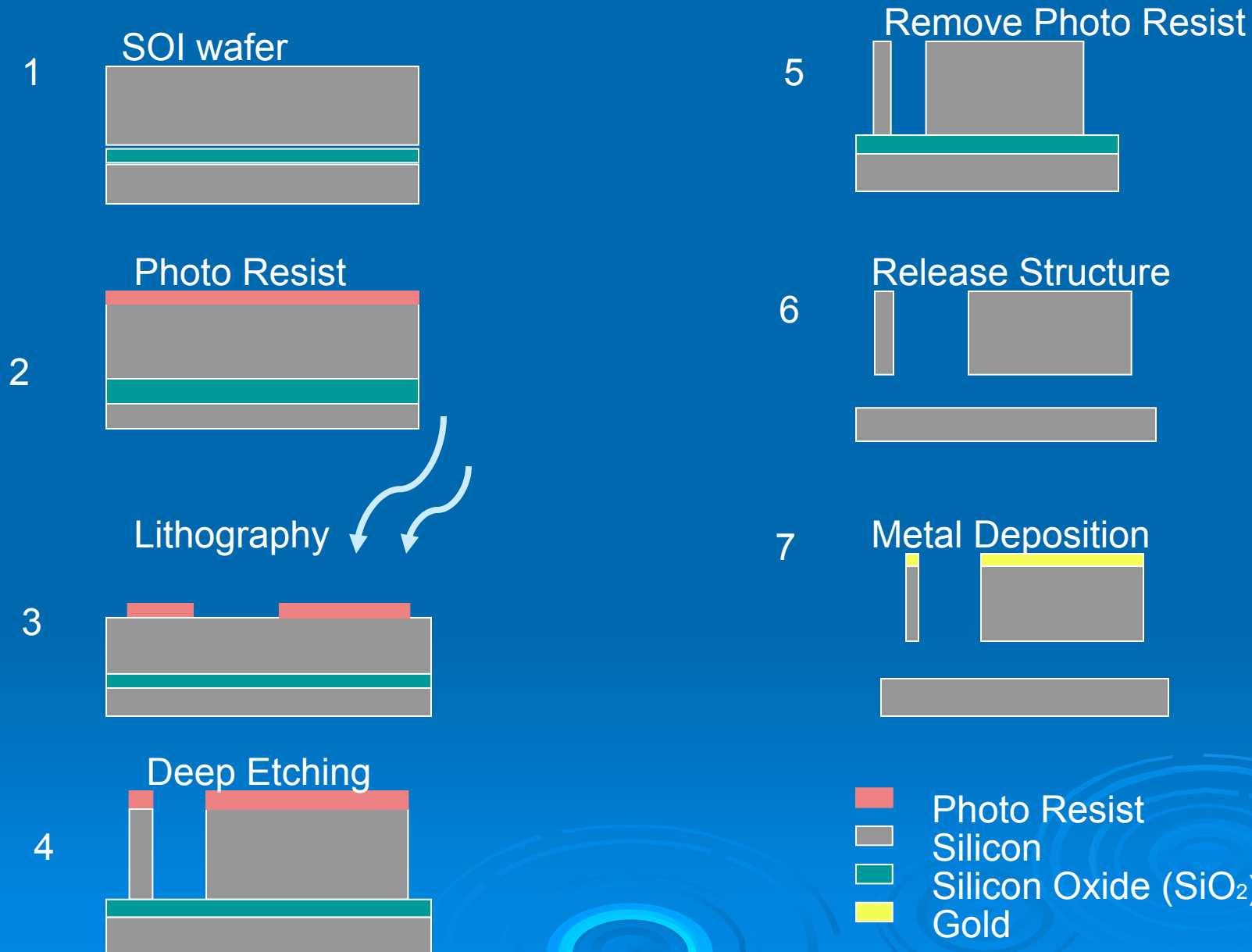
• Actuator 2

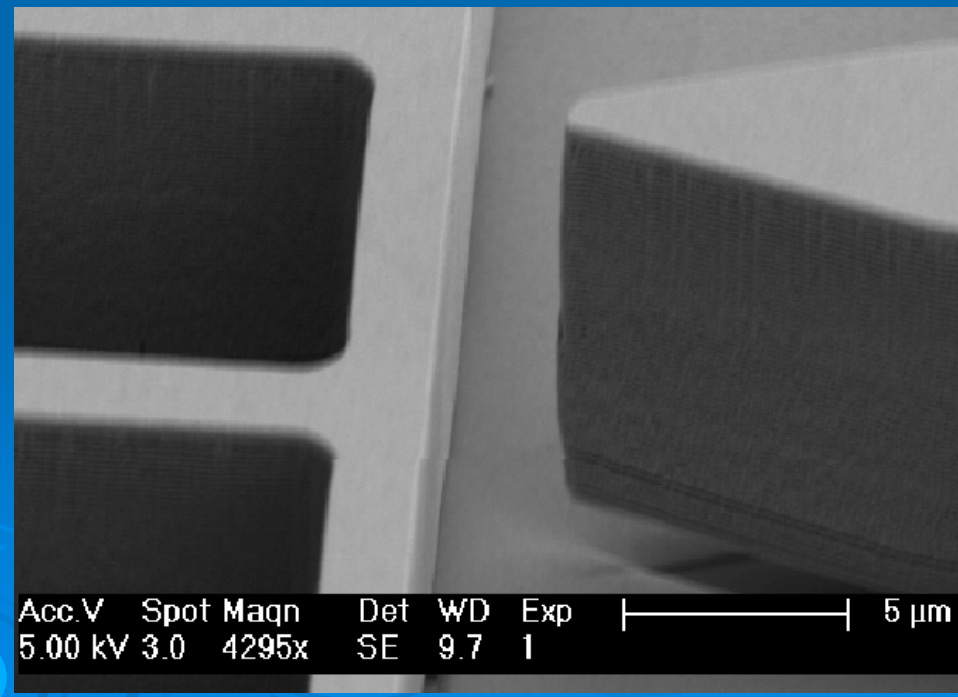
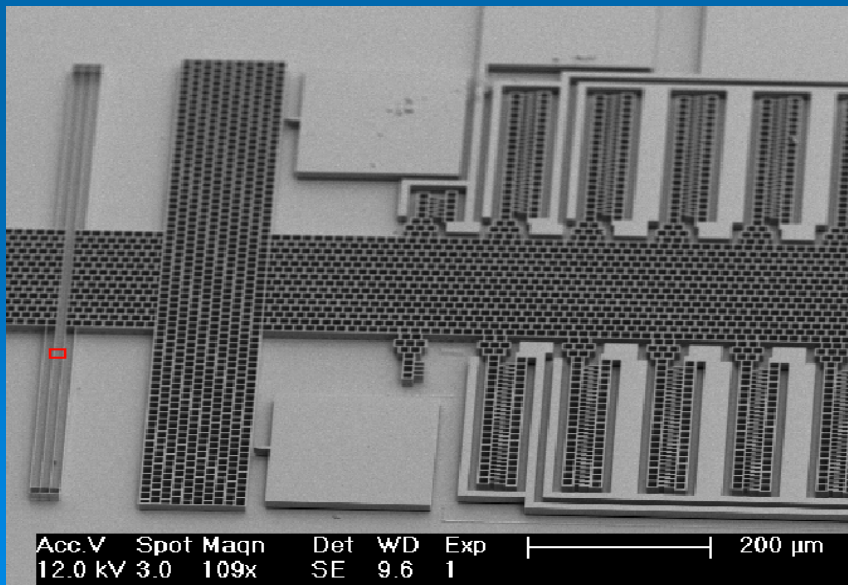
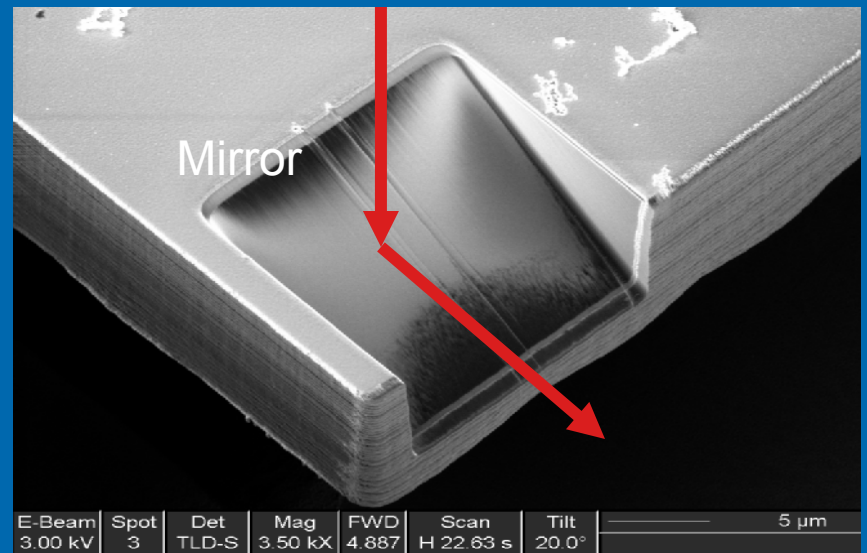
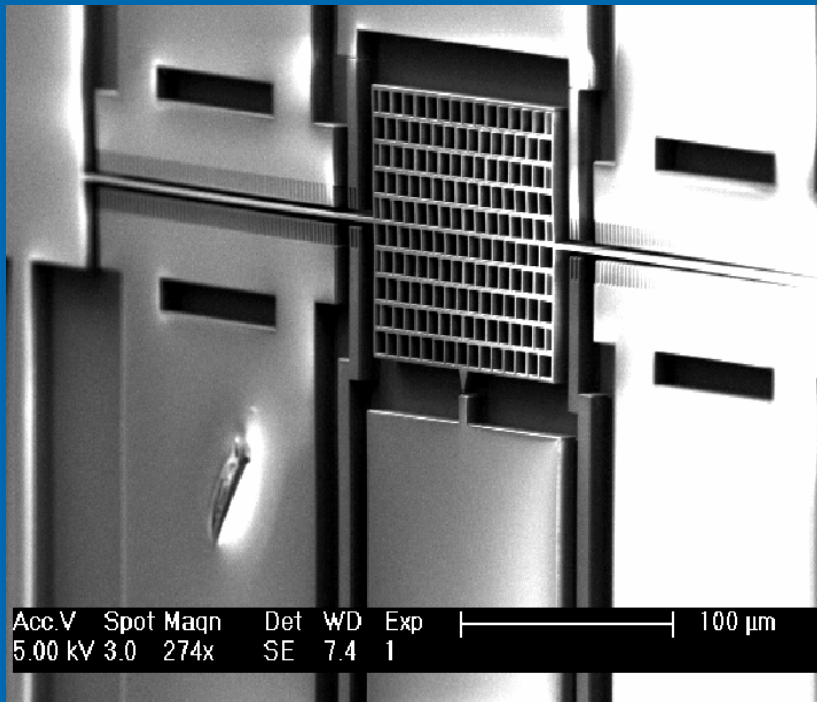
* Interdigitated Comb-Fingers



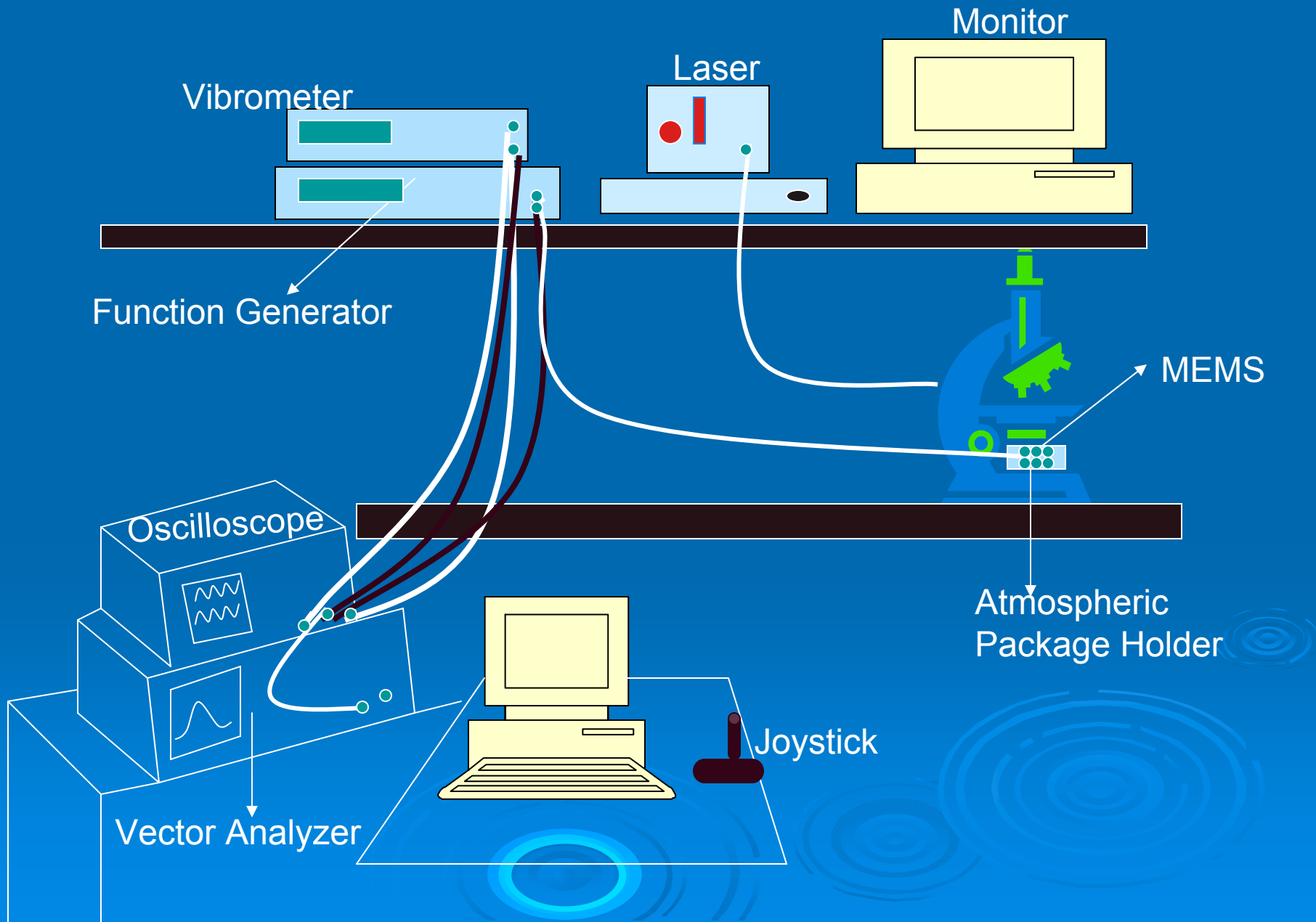
Ultra high sensitive!

SOI Fabrication Process

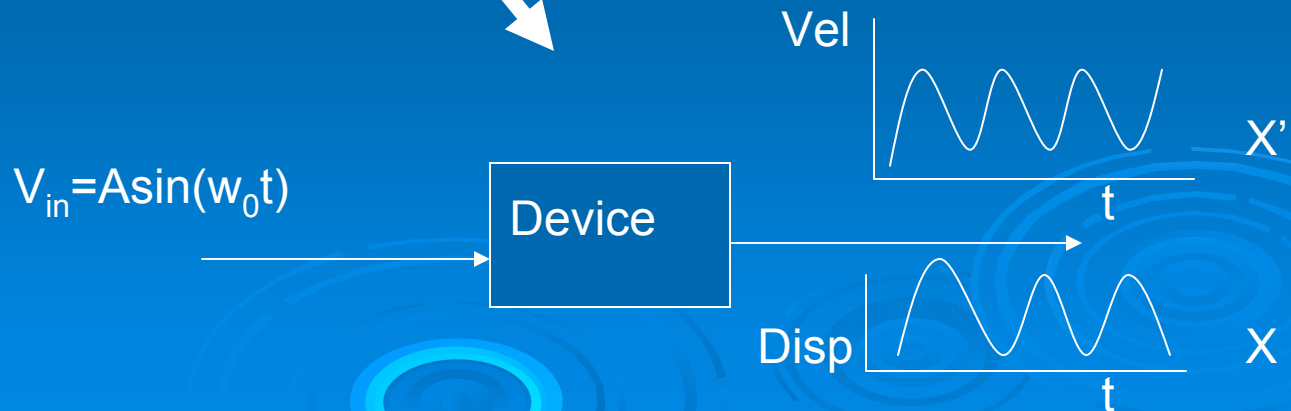
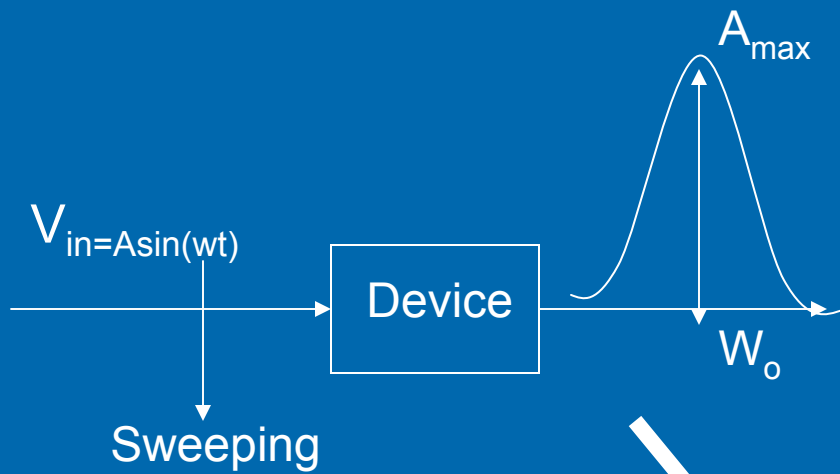




Equipment for testing

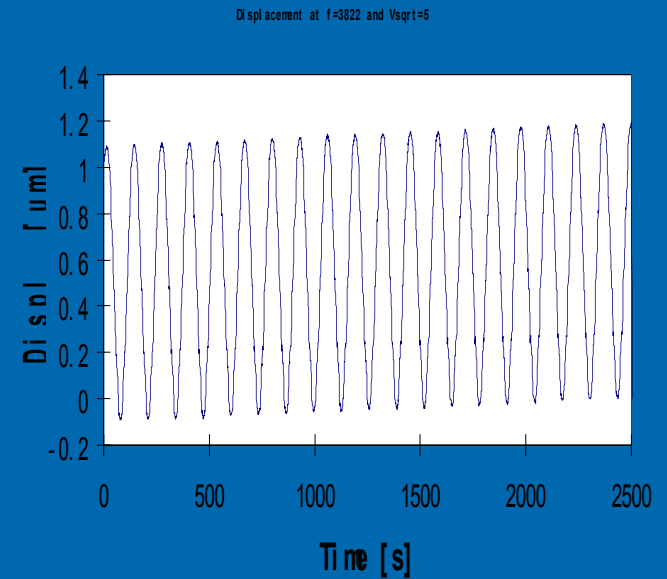
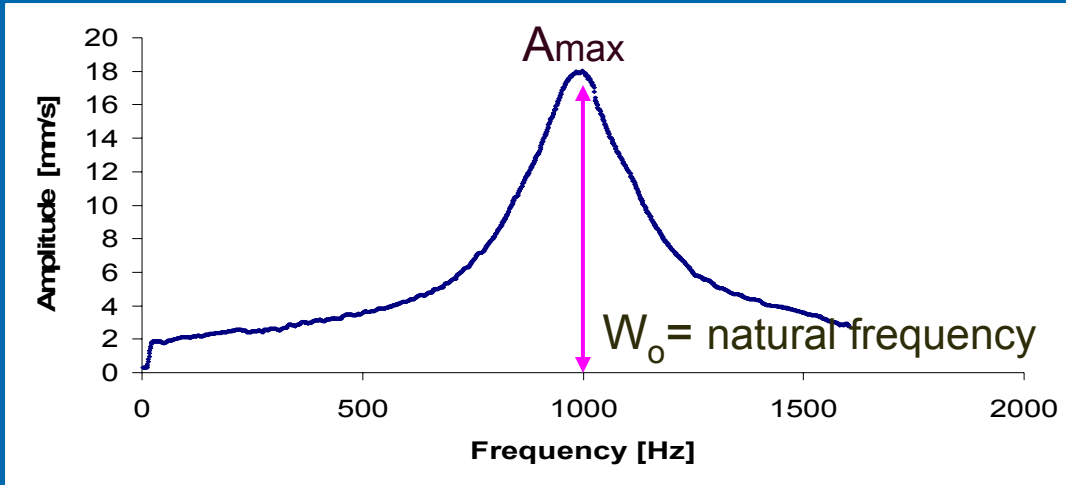


Frequency Response Analysis

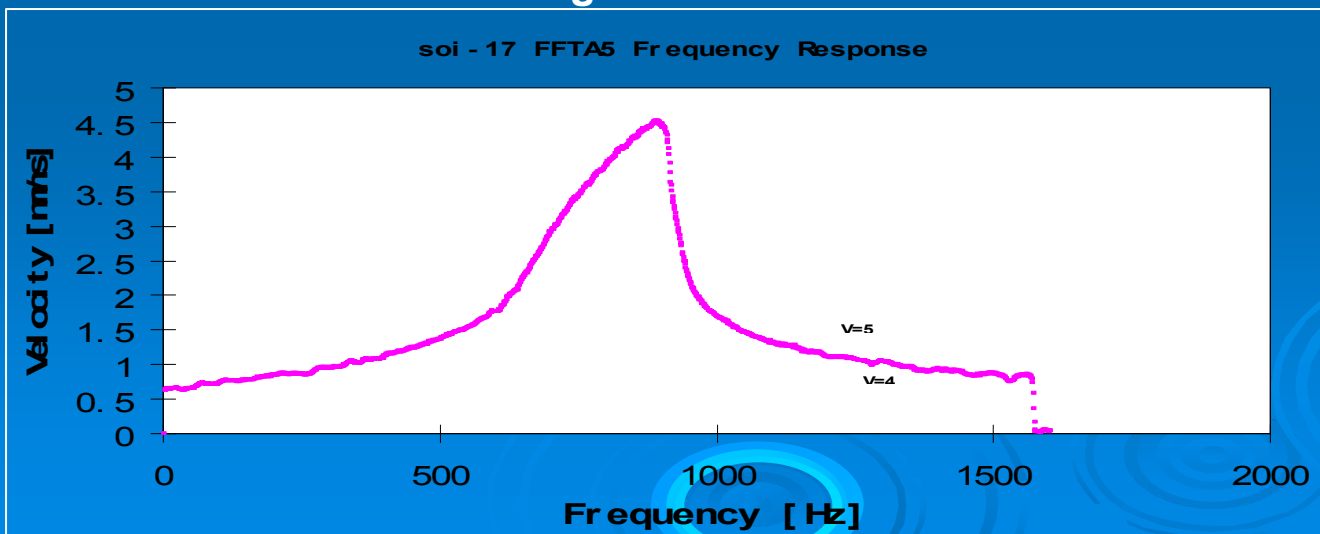


Results

Large Lateral Tunneling Accelerometer



Fix-Fix Lateral Tunneling Accelerometer



Summary

- Getting familiar with MEMS
- Understand Micromachining process
- Understand the dynamical parameter of lateral tunneling accelerometer
- Work with High-Tech equipment
- Visit clean room
- Visit the FIB room
- Learn about the life of grad students
- **THE MOST EXCITING activity: participating in the micro-fabrication of lateral tunneling accelerometer and their characterization!**



Acknowledgements

- Mentor: Laura Oropeza
- Advisor: Kimberly Turner
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- UCSB
- ICB

